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NOVEMBER, 1904. VOL. XXIV. NO. 5.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The Geographical Journal.

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NOTICES.*

Meetings in November.—Monday, November 7. The National Antarctic Expedition. By Captain Robert F. Scott, R.N., C.V.O. (in the Albert Hall).—**Monday, November 21.** Exploration in the Western Himalayas. By Dr. Hunter Workman.

The Year Book.—The Year Book for 1904 is now ready, and can be obtained by any Fellow by applying personally or by letter to the Chief Clerk, 1, Savile Row, London, W.

Notice to Fellows in Arrears.—The Council desire to intimate that the Society's publications will not be forwarded to Fellows who are in arrears with their subscription for six months or over.

Any Fellow resident in this country, desiring to have notice of the subjects of papers to be read at the Society's Meetings forwarded to him, can receive such notices by post on payment in advance to the Chief Clerk, at 1, Savile Row, of 2s. per session.

The Society's House will remain open for the Convenience of Fellows on the evenings of the Society's ordinary meetings till 8.15.

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* See also pp. vi., viii. and x.

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The
Geographical Journal.

No. 5. NOVEMBER, 1904. Vol. XXIV.

THE ANGLO-FRENCH NIGER-CHAD BOUNDARY COMMISSION.*

By Lieut.-Colonel G. S. McD. ELLIOT, R.E.

The work of the Boundary Commission that left England in October, 1902, was to ascertain on the spot where the frontier between the river Niger and Lake Chad, defined in the Anglo-French Convention of 1898, actually lay. The country through which this frontier passes was little known at the time of the signature of the Convention, so the delegates were forced to content themselves by defining it for the greater part in geometrical terms. Briefly it was this: Starting from the Niger 10 miles above Giris, it was to follow the median line of the depression known as the Dallul Mauri till this line intersected an arc of 100 miles' radius, with the town of Sokoto as centre. From this intersection point the arc itself was the boundary for about 300 miles, till to the north-east of Sokoto it cut for the second time the parallel of 14° N. lat. This parallel was to be followed for the next 70 miles, and then the meridian of longitude thus arrived at down to its meeting with the parallel of 13° 20′ N. lat., along which the frontier was to run for 250 miles, next a meridian of longitude from this point was to be followed north till the 14° N. was regained, and this again became the frontier till it intersected a third meridian of longitude lying out in Lake Chad, 35′ east of the centre of the town of Kukawa. This third meridian from this intersection point till it reached the southern shore of Lake Chad formed the last section of the boundary.

The line thus traced, though crossed in various parts, had not been followed for any distance by previous travellers. Denham, Clapperton, Oudney, Barth, Monteil, and others had between them visited Kuka,

* Read at the Royal Geographical Society, June 27, 1904. Map, p. 616.

Kano, Katsena, Sokoto, and Zinder; but the line of the frontier now under consideration, lying as it did in an uninteresting and sparsely inhabited country at the edge of the desert, was, naturally enough, not visited when so much that was interesting and important was little if at all known.

In 1900, Major Lang-Hyde, C.M.G., of the Royal Engineers, had surveyed the Dallul Mauri to some distance beyond its intersection with the arc of 100 miles' radius round Sokoto, and had put beyond question where and what the Dallul Mauri was. Captain Merrick, of the Royal Artillery, who was in command of the Argungu column in 1902, had with his officers made useful reconnaissance sketches round the arc and beyond as far as Maradi. Captain Mundy, Assistant-Resident, had done the same for a portion of West Bornu.

A boat from Liverpool takes the traveller to the Forcados mouth of the Niger, where at Burutu a stern-wheel river-steamer is in waiting to carry him up the river. For about 100 miles the way lies through the delta, a region of swamps, creeks, and dense forests, among which, after passing through the last of the rocky barriers that separate the coast-belt from the interior, are distributed the waters of the Niger and the Benue. Near the sea the mangrove is the most striking of the creek vegetation. Farther up palms, most important of which is the one whose nuts furnish the palm oil of commerce, are more conspicuous as the land becomes firmer. Villages, whose inhabitants are expert canoeists, are passed more frequently, and occasionally a trading-station. Crocodiles are plentiful everywhere, and sometimes a herd of hippo, creatures most thoroughly in keeping with their surroundings, is seen, their heads appearing and disappearing at intervals. Just before the ascending steamer enters the channel of the Niger, which discharges itself near Akassa, the Forcados river narrows considerably, and this main channel is gained by a sharp right-angle turn. All up the river the forest grows right up to the edge of the banks, and as these are continually being cut away, the trees on them fall into the water, and are carried down till they take the ground in some shallow spot and alter the set of the current, causing silt in one place and scour in another, thus adding to the difficulties of navigation. Lokoja, opposite the confluence of the Niger and Benue, may be considered the port of entry of Northern Nigeria. It was here we enjoyed the hospitality of the 2nd Northern Nigeria Regiment, and made the acquaintance of some of the troops who were destined to take part in the Kano-Sokoto campaign.

For most months in the year steamers can go between Lokoja and Jebba, the former headquarters of Northern Nigeria, another 200 miles up the river. At Jebba one must take to the native canoes. These are hollowed-out logs, propelled by poles made out of the central stems of palm leaves, which are called "bamboos" in Northern Nigeria. In places where the current runs swift and deep under a woody bank, the

canoemen have to resort to the tedious process of forcing their craft up-stream by catching and hauling on the overhanging branches. At others, and more particularly above Bussa, where large beds of reeds border the channel, and the water is too deep for poling, cross-pieces of stick about a foot long are lashed to the end of the bamboos, and thus a

FOREST SCENERY, LOWER NIGER.

purchase is obtained on the reeds. This operation disturbs countless mosquitoes, who are not slow in giving expression to their resentment. Paddles are used in the deeper part of the river, particularly when, as is often the case, it is desirable to cross to get into a favourable stretch for poling.

All the river-side people, and particularly the Nupes, are expert canoemen. They commence poling at a very early age. Their skill is most conspicuous where the stream runs wildly amongst boulders or over sunken snags. Only one of the Boundary Commission canoes was upset, and this was in some rapids above Bajibo. All the contents were successfully fished out of the river, with the exception of one bale of cloth. A long canoe journey up-stream is to be avoided if possible. Sitting all day under a mat shelter in a narrow dug-out gets wearisome long before the three weeks' journey from Jebba to the frontier is accomplished. If steel canoes, such as the French use in their journeys with the Niger flotilla, are forthcoming, the discomforts are considerably lessened, the more so as it is possible to sleep on board and avoid camping, often on swamps alive with mosquitoes. The dug-outs, too, are more or less leaky, and some care has to be exercised to prevent the loads

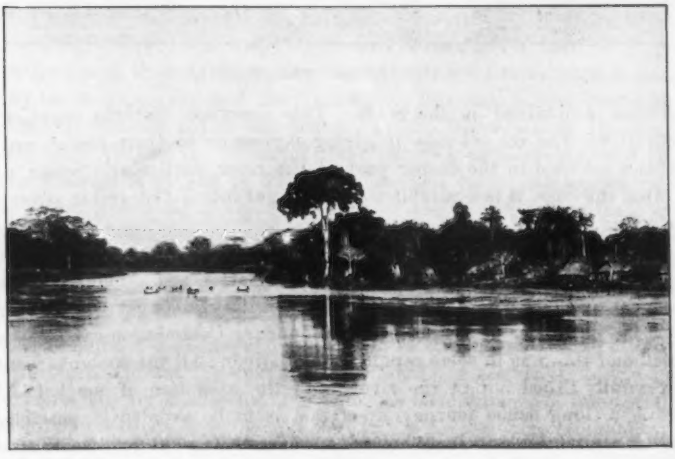
placed in them being damaged. Above Jebba rapids are frequent, but they are negotiable by the skilled Nupe canoemen, till the Wurroo rapids are reached. Between this spot and Bussa there are a series of rapids, of which three are formidable. It is advisable, in fact necessary, to unload the canoes and send the loads round by land, whilst the canoes are hauled up empty.

It was in one of these rapids that the dauntless Mungo Park met his death, when he appeared to be, after braving countless difficulties and dangers, on the point of solving the mystery of the Niger's course.

After surmounting the big rapids near Bussa, the river was still full of smaller ones that gave more or less trouble till, a few miles above Yelwa, a quieter section of the river was entered, and the journey to the frontier was accomplished without further difficulty.

Dole, near which village is the westernmost end of the boundary, lies a little way back from the Niger, on its left or eastern bank up a marsh-fringed creek. Marshes border the river for a mile or so in depth, and clumps of fan palms indicate spots where the ground is more solid. These trees are plentiful on the land side of the marshes and for some way up the Dallul Mauri.

Dallul Mauri, or the valley of the Mauris, the people of Arewa, is the name applied in the Convention to a depression that can be traced with more or less distinctness from near Matankari down to its junction with



JUNCTION OF RIVER NIGER WITH DELTA.

the Niger, the Dole creek being its mouth. It was once, I consider, a river valley, but no river or stream now flows along it, except perhaps during the rains there may be a current from marsh to marsh in the lower part of its course.

The term "Dallul Mauri" is only correct for the portion of the depression that lies in the Mauri country, from near Nasserawa on the north

LAKE CHAD.

to Goru on the south. The lower portion of its course from the Niger up to its bifurcation opposite to the village of Banna is called Rafin Foga, or the Valley of Salt. This name of Rafin Foga is retained, and properly so, by the more western branch that lies in French territory, for the salt marshes to which it is due do not extend up the so-called Dallul Mauri beyond this junction point.

Leaving the Dole creek and following the valley, which must henceforward for its whole length bear the name of Dallul Mauri, we come on a grassy valley with fan palms in abundance, at first several miles in width, but gradually narrowing as we ascend. A series of depressions —the beds of marshes, dry at the time of our visits in December and January, but along which in the rains a stream doubtless flows—mark what appeared to be "the median line." On either hand bush-covered laterite scarps, more or less interrupted by side valleys, define the borders. Farther up, above the junction with the Rafin Foga, these scarps disappear on the left or west side; gently rising rolling ground, which recedes considerably as the valley widens again above Yelu, takes their place, whilst on the right, though in places hard to trace owing to

bush-covered under features, they are fairly continuous up to Nasserawa. Here there is a break of some 25 miles, after which they reappear at Budu, and, passing Matankari, trend away eastward and disappear.

The cross-section of the upper portion of the depression appears to be that of a line of fault, the eastern side being the upthrow, and the western the downthrow. From the junction of the Rafin Foga down to the Niger, the valley may have been formed by the action of water, possibly that of the Rafin Foga, but more probably there was a double fault, forming a rift-valley similar to those in East Africa. At the junction of the Rafin Foga and Dallul Mauri, and for some miles below, the water had not dried out of the marshes, and it was there that the salt villages were most numerous. Above the junction-point the bed of the valley was dry in December, the long grass and reeds are scarcer and the bush is thicker. Fan and borassus palms and large forest trees still abound, as well as evidences of the visits of elephants, giraffes, and other game during the rains. Gradually the larger trees give place to smaller varieties and thorn bushes. The shea butter tree becomes scarce after passing Yelu, the palms between Yelu and Junju and the baobab disappear almost entirely before reaching Matankari.

Dry beds of marshes, often long enough to suggest that they form a continuous channel, but really disconnected, are found right up to the

BUSSA RAPIDS.

arc. The point arose whether the median line of the Dallul Mauri was to be considered to lie along the middle of these marshes or midway

between the crests of the high ground on each side of the valley—by no means the same thing. Both views presented difficulties, but the

WOMEN TILLING FIELDS.

natives considered the Dallul to be that part of the depression where the fan palms grew, and these were only to be found where their roots could get moisture, and consequently close to the marshes. The middle line of these was therefore, with a certain amount of give and take, adopted as the median line of the Dallul Mauri.

Round the arc as far as Illela the country consists of gentle undulations of sand covered with thorny bush. In places scarps rising abruptly mark the edge of laterite plateaux that fall gently away till they blend with the general level of the ground. Occasionally a few outliers from these cliffs form prominent features.

Near Illela are groups of hills of dark, coarsely crystalline rock, I think of volcanic origin, possibly of later date than the laterite and intrusive. Some of these rise to a greater height—about 400 feet above the general level of the country—than any hitherto encountered.

After passing Illela, the arc crosses a series of valleys or rifts in the laterite sheet, which is here much more generally in evidence. These valleys have their origin outside the arc, most of them apparently to the north-east of Tawa, and were doubtless once drained by streams that were affluents of the Sokoto Gulbi, through which their waters reached the Niger.

They are much more pronounced than the Dallul Mauri or any of

the depressions met with previously, being usually about one mile wide and 200 feet (or more) deep, and, though possibly in places originating along cracks in the lava-sheet that at one time overspread the country, were, as their cross-section shows, cut down to their present depth by the action of water. Water is often found in them at a little depth below the surface, and the soil is more fertile and vegetation larger and more plentiful than on the laterite crust of the plateau. Like the Dallul Mauri, they do not now appear to be drained continuously throughout their length, for the portion of the rainfall that does not soak into the soil at once, forms pools along their courses.

I noticed the following geological section in one of them between Tawal and Bussa. First, the laterite; second, shale, laminated like pressed tobacco-leaves; third, chalk and clay mixed; fourth, chalk; fifth, shales. The strata were horizontal. In places, doubtless owing to denudation, the upper shales had been removed, and the laterite lay on the chalk, which was more or less baked and hardened in consequence. The chalk was full of echinoids and other fossils. Wherever, in this neighbourhood, I saw strata exposed, this section seemed to prevail. Probably it goes as far south as Sokoto or further, for the resident there, Major Burdon, showed me a piece of indurated chalk which he had found in a watercourse to the east of the city.

CARRIERS DRINKING AT RAIN-WATER PUDDLE.

The laterite plateau terminated near Chara and Bussa in scarps the highest encountered on the border, which trended away eastward and

northward into the desert. The Duchin Zana, a large hill which lies a little to the north of the intersection of the arc with the parallel of 14° N. lat., is probably an outlier from the plateau.

It is with considerable diffidence that I put forward any geological theory; in fact, it is only in the hopes of provoking discussion on the subject, and because it enables me to give more clearly the impression produced by what I observed, that I venture to do so.

It appeared to me that the whole region lying along the frontier from the Niger to the bluffs near Bussa and the Duchin Zana, extending to the north as far as Tawa, or even further, and possibly to the south

A STREET IN KANO.

as far as Sokoto, had, some time after the deposition of the shale above the chalk, been covered with a sheet of lava, of which the laterite is now the remains. The portion of this sheet lying east of the line Illela-Tawa must have become subject to subaërial denudation for some long period before the westerly portion, to account for the very much greater depth of the valleys. Probably, therefore, when the lava flowed over the bottom of the shallow waters in which the shales were being deposited, the earth-crust in this region was undergoing a gradual upheaval, the eastern portion rising before and higher than the western. Possibly the mud flats which are now the shales were above water at this time; certainly parts of them were, as is testified by the laterite resting in places on the chalk.

Whatever was the case, the climate of that part of Africa must have been very different from what it is now. These deep valleys must, I think, have been hollowed out by the action of water at a time when large lakes and inland seas occupied regions that are now desert. Since these disappeared, the prevailing winds have been spreading the sand that lay in their beds over what was once probably a well-wooded and pleasant land. Thus to-day we see work done in ages long past by water in carving out hills and valleys being undone by wind, which is blocking the valleys and building hills of its own, whilst it removes for the purpose all the loose soil it can gather and bears it steadily south-westward.

The drainage of the country must be chiefly subterranean. Possibly much of it finds its outlet in the marshes bordering the Niger. Though water is still doing something to alter the face of the land, Æolian influences are more in evidence here than in any country I have yet seen. The lee side of every rock, bush, or tuft of grass becomes the starting-point of a sand-dune, the material for which is being carried from more exposed situations; whilst these sand-dunes themselves gradually work down-wind unless and until their surface is consolidated and protected by vegetation. The rainfall is not sufficient to form currents strong enough to break through the obstacles thus piled up across the old lines of drainage, and the water collects in pools and hollows, from which it soon disappears by evaporation and infiltration. The old features shaped by the action of water are thus being obliterated and the country is, in consequence, most difficult to survey rapidly and satisfactorily, for it possesses few striking features, and no general system of surface drainage that may readily be seized on.

The rains commence in June and last till the end of September. Except in August, however, such a thing as a really wet day is rare. Captain Moll, the French Commissioner, told me that in his experience the week in that month in which the moon was full was the rainiest of the year, and it certainly was the case in 1903. Three or four storms a week is about the usual average for the rainy season. About two months after the rains have ceased, *i.e.* the end of November, the Harmattan sets in, and blows steadily from the north-east till April. During this time the air is misty with suspended dust; sometimes, so thick is the haze, the largest objects are invisible at half a mile. Vegetation dries up, and everything gets covered with the finest powder. The temperatures in December and January are from 100° Fahr. by day to 60° Fahr. by night. April is the hottest month; the day temperature reached 114° Fahr. in the shade, and the lowest it fell to at night was 78° Fahr.

During April and May the wind at times blows from other quarters, the air gets clearer, clouds gather, sandstorms get more frequent, till they become a daily institution, and a few drops of rain occasionally

raise hopes that are usually disappointed till June is near, and the first real shower is hailed with cries of delight from the people, who are now assured that the seed they have sown will not perish in the ground.

MARKET-PLACE, KANO.

The temperature ranges from 113° Fahr. by day to 76° Fahr. by night. Grass and verdure appear everywhere, and all conditions have changed for the better.

Except during the rains and for a short time after, the only water in these regions is in deep wells at the villages. As the bush dries up, the larger animals that have come into them for the sake of the fresh grass take their departure for better-watered spots, but there are a certain number of smaller mammals and birds that live here the whole year through. We noticed oribi, gazelles, wild cats, certain burrowers and rodents, guinea-fowl, francolin, hornbills, bustard, various birds of prey, and many small birds. The problem of how they managed to exist without water appeared a puzzling one. I mentioned this difficulty to some French officers, whom I have always found to be very well informed and careful observers. They drew my attention to the fact that there was, even at the end of the dry season, moisture in the leaves and twigs of certain plants, and, further, that it was probable that the bodies of white ants supplied birds with all the liquid they required. These little creatures cover everything they are going to attack with galleries made out of clay. To moisten this clay they must have water, which they bring from considerable depths. The officer in charge of the well-sinking along the road from Filingi to Tawa told me that white ants had been found 50 metres below the surface in some of the

wells. That these small insects should be capable of bringing up all the water they require for their work from depths like this appears marvellous; but no less so is the existence of the larger animals in a district where for half the year the air is hot and dust-laden, and not a drop of water exists on the surface.

From the end of the arc till the Salt Desert is reached, the general character of the country is much the same as that which has just been described. Laterite is not so much in evidence. Granite was first noticed between Maradi and Katsena, presumably of later date than the laterite, and intruded through it. It took the shape of rounded masses or heaps of boulders, which at times formed conspicuous landmarks. Nowhere did I again see any trace of aqueous rocks. There were the same undulating sandy downs, with no great elevations or depressions; but villages and cultivation were more frequent. Near Maradi we crossed several times the first river we had encountered since leaving the Niger, and this only has water for a few months in the year. It was a very respectable stream in September, and we were glad when our loads were safely over. As one approached Machena, the country got more open, and though the prospect, limited as it was by the Harmattan haze, was not very inviting, it was, nevertheless, a relief to the eye after the monotonous and uninteresting bush through which we had been travelling for nearly a year. Before getting as far as this the Niger basin has been left, but between it and that of Chad there appears to be

KANO.

no well-defined or recognizable watershed, for the surface drainage of the country is into pools and hollows.

Continuing eastward, the Salt Desert is entered. The meridian

that ascends northward from the parallel of 13° 20′ N. to 14° N. passes roughly through the middle of it. Contrary to expectation, this is not a dreary waste of salt-encrusted desert sand, but open plains, sandy certainly, but covered with waving grass about 4 feet high, diversified here and there by lines of borassus palms which mark the course of depressions, where water is usually to be found at a small depth below the surface even if they do not contain pools. When we passed through in November, the grass was all dried up, and the horrible burr called the kram-kram was here, as everywhere we went, plentiful. When green in the rainy season, the

VIEW OF BEBEJI, SOUTH OF KANO.

Salt Desert must, comparatively speaking, be a pleasant spot. As one gets further into it the lines of borassus palms are scarcer, and the country appears to be an unbroken rolling prairie, till every now and then a deep hollow, invisible till the edge is reached, is suddenly come upon. Some of these hollows were dry or drying, whilst others contained water deep enough for hippopotami. Round the edge of the water is usually a dense fringe of handsome feathery reeds, infested by large and fierce mosquitoes, and on the firm ground round the reeds again a thick belt of borassus palms. The hollows were of varying sizes and shapes, sometimes roughly circular and about half a mile to a mile across, and about 100 feet or more in depth. Others were long and irregular in outline. They always formed, when there was water in them, a pleasing and welcome picture. I could find no way of accounting for their origin except on the supposition that they are craters or crevices in the lava-sheets that probably underlie the sand,

and that most of the water in them is from a subterranean drainage system.

Wherever water dried in the salt desert it left a deposit behind it, sometimes of potash, and sometimes of what the African is pleased to consider table salt. Two pans close together would, curiously enough, contain deposits one of potash and one of salt. The salt deposits were worked in the same way as in the Dallul Mauri and Rafin Foga. As the water dries off the marshes or pans after the rains, the salt workers, who often hail from far, come and establish themselves at the workings in temporary shelters made of palm leaves or grass. They scrape up the soil newly impregnated by the evaporated and infiltrated water, carry it off, and fill it into strong baskets placed in a frame above an earthen pot. Water is poured over to dissolve out the salt, and when the receiver below is full of brine, it is taken away and evaporated by boiling. The salt thus obtained is not pleasant to European taste, nor is it advisable to indulge freely in it. It is neatly packed in mats made of palm leaves and carried long distances to trade.

Between the salt desert and Chad is a bush-covered tract, waterless in the dry season, except for a few wells known to nomads and hunters. From Zinder a route traverses this, keeping a little north of the 14th parallel of north latitude. After passing a group of villages near where the frontier regains this parallel, some 40 odd miles without water have to be traversed before the Mir oasis is reached. From this there is another waterless stretch of 70 miles to the shores of Lake Chad at Wudi.

South of the desert runs the river that flows past Yo into Lake Chad, near the town of Bosso. It is called Komadugu Waubé; Komadugu meaning "water" or "river." We struck it about 6 miles from Kabi, and entered on a region of trees and cultivation such as we had not seen since we left the Niger. It is about 50 yards wide, and flows in a winding channel between grassy banks about 6 to 10 feet deep. It was only fordable in places, but at the end of December the water was falling rapidly. It is bordered by large marshes, which render it impossible to follow the banks for any distance.

A few miles to the north of the mouth of this river the first view of Chad was obtained. We emerged from low forest on to a plain covered with longish withered grass that towards the horizon was green, and seemed to rise here and there in hummocky undulations. As we pressed forward, eager to see the great lake, we found that by the time the green grass was reached we were in water, and that the hummocks were reed patches which continued to extend to the horizon. The water gradually deepened as we went on, and clouds of mosquitoes, stirred up by our horses' feet, assailed us viciously.

We had reached the Chad.

The western shores of the lake are very flat. Some miles back from the water's edge is a line of sand-dunes, covered with low

thick forest. This is fringed with a belt of euphorbia, of varying depth, and then the open grassy plain falls very gently to the marshes. These, with patches of open water, appear to extend right across the lake in its southern portion, whilst the northern is much freer. Owing to the absence of any sufficiently high ground near the shore, and to the Harmattan haze, it was impossible to get any very extended view. From the sand-dunes near Barrua large stretches of open water were visible, and again, near the mouth of the Yo river, the lake appeared to be free from reeds up to the eastern horizon. Below this, on the shore opposite Aregi, where we camped on New Year's Day, and for some 15 miles southward, a line of breakers could be seen and heard along the outer fringe of the marshes, but after wading out to this, the tops of grass and reeds were visible here and there above the water as far as the eye could reach. The strong Harmattan wind was blowing steadily throughout the day, and piling the waters on the western shore. About sunset it died away, and the lake receded some hundreds of yards before morning. The grassy plain lying between the forest and the marshes varies in width from 1 or 2 miles to 10 or more. Abundance of fish-bones and hippo skulls scattered over it showed that it must at times be under water. I do not, however, believe that the rainfall in the Chad basin can ever raise the level of the lake considerably. It seems like other great lakes, notably Lake Van in eastern Turkey in Asia, to have periods of high lake at a certain regular interval of years. Between these the lake gradually falls and then rises again. This was brought to my notice by Colonel Jackson, of the Anglo-German Boundary Commission, who, no doubt, will be able to throw a good deal more light on the subject. The high and low water level, then, cannot depend directly on the annual rainfall, but is possibly due to some large underground syphon or system of syphons, which take a certain number of years to fill and empty. Curiously enough, if I remember rightly, the period given me by Colonel Jackson for Lake Chad, eleven years, is the same as that for Lake Van. It would be interesting to get reliable statistics on the periods of high and low water of the various lakes subject to this phenomenon.

In the waterless districts we had passed through from the Niger game was scarce and wild. Now, as we rode along the shores of the lake, we had animals of some sort ever in sight. Herds of korrigon, a species of hartebeeste first found on Lake Chad by Denham, gazelles of several species, notably a very handsome red and white one that may prove to be a new sub-species of the *Gazella Dama*, galloped away from us all over the grassy plain. The marshes were full of wildfowl, and close to or in them, that handsome little antelope, the cob, stood up to gaze at the passing caravan. A few ostriches were seen, and one was found sitting on its nest, a hollow in the sand containing 21 eggs. Hippo tracks were plentiful, and occasionally a herd of elephants, noblest

and strangest sight of all to unaccustomed eyes, would emerge from the forest and make their way with grave deliberation to the water's edge.

Before the reading of the paper, the PRESIDENT said: We have the pleasure this evening of having with us Colonel Elliot, Commissioner for the Franco-British Boundary Commission between the Niger and Lake Chad. He will give us an interesting account of that region, which has scarcely ever before been visited by a European, I believe. I will now ask Colonel Elliot to address you.

After the reading of the paper, the following discussion took place:—

Major BURDON: A great portion of this region that Colonel Elliot has described to-night has just been given away to France. His journey, therefore, and description are deeply interesting, because in the future it is very improbable that any British officer will be allowed to go into that country, except possibly for scientific purposes, and that not at present. I have a personal feeling of gratitude to Colonel Elliot for his description, for the information he has given me, and the maps he has given me, for that 100-mile arc round Sokoto was in my district. Now, possibly, I shall never have a chance of visiting it again. Colonel Elliot has gone into the geology of that part of the country. I think the most striking thing is that laterite plateau he has spoken about which reaches from Illela right down to Lokoja, a distance of about 400 miles. It seems to me to be absolutely flat, and keeps the same level above the sea throughout. The only difference is that as you get lower down south towards the sea the valleys become deeper. There is one break in it which extends to about the 11th parallel from Yelua on the Niger right across to the Kaduna river. That, I believe, is granitic, and the rock is entirely different from the laterite formation on the north and again on the south, and it is in that region that you will find the rapids Colonel Elliot showed you. Colonel Elliot touched on the alteration in the drainage of the country. You will remember that he showed a scene on the Sokoto river with his caravan crossing it waist-deep. Two months later than that photograph was taken, after the rains, when the rivers were very much fuller, I tried to get up from the south, and found there was no outlet at all. The whole of that mass of water was absolutely lost in a marsh. It never flowed into the river to which it should have been an affluent at all; it never reached the Niger. The natives said it had been growing less and less for several years past, and I think it is a very striking example of what Colonel Elliot said about the rivers being blocked up by the action of the air and the sand off the Sahara. Luckily, in this case, the British occupation has come in time, and the river has been cut so that it now flows; and during three or four months in the year there is, therefore, river communication right up to Sokoto. Colonel Monteil passed along there some twelve years ago, and accounted for the various valleys as being old arms of the Saharan sea. It seems to me it is much simpler to explain the loss of water by the theory Colonel Elliot has suggested—the simple blocking up of the rivers by the sand from the Sahara. In showing a picture of a stockaded village, Colonel Elliot described the lawlessness of the country, and spoke in the present tense. What he said was quite true at the time that he passed through the country, but that was before the British occupation, so that I hope you will regard it as an historical tale now. That lawlessness does not exist, and there is nothing more striking or encouraging in the result of British occupation than the way in which the people allow all their fortifications and walls to fall into decay at once. They say openly they no longer have any need for them.

Dr. BATHER (Assistant Keeper of Geology, British Museum): Among the

results of this expedition there are many of great interest, and some of them perhaps a little unexpected. Among them are the geological results which have been alluded to by Colonel Elliot in his paper. The officers of the expedition fortunately brought home with them a fair number of fossils, which were collected at various points upon this boundary-line, especially near Garadumi, which you will see on the arc near longitude six, and at Tamaské, which I think is further to the west. These fossils were brought to the British Museum, and were studied by Mr. Bullen Newton and myself. Fossils were also found by the French officers on the expedition, and there have been some remarks published on these, though they are not yet described. In ignorance of this, we studied these fossils, and we came to the same conclusion as the French scientists came to. The fossils are shells and sea-urchins for the most part, and the important point about them is that they denote the existence of a rock of Eocene age, which rock had not previously been found in that district. Rocks of similar age occur along the northern part of Africa towards Tripoli and Tunis. They are also known to pass through Arabia and down towards Somaliland, but in the district south of Algeria no rocks of this age had been previously known to exist. It is true that some years ago Rohlfs mentioned that he had seen ammonites in the neighbourhood of Bilma, which is a little north-west of Chad, and Cretaceous rocks were found there by the officers of the French expedition, and also by Colonel Monteil, whose name has been mentioned this evening. Now, the existence of Eocene rocks is a point of importance, not merely as showing an extension of the sea over the southern part of the Sahara in those times, but as affording some confirmation of the views of Suess, who has supposed that, while the lower triangle of Africa was raised out of the sea at a very early geological age, all this Saharan part of Africa, together with the present Mediterranean, Arabia, and the North-West Provinces of India, formed one great Mediterranean sea. We have here proof for the first time that this sea actually did exist down to Sokoto, or at all events a little to the north of Sokoto, forming the southern limit of the present Sahara. And what is an interesting point in these fossils, and still further confirmation of these views, is that some of the fossils that have been found are distinctly of Indian character. One of the sea-urchins is of a kind which has hitherto only been described from Sindh. It is very interesting to learn, though the fact has not yet been definitely published, that a species of the same genus has recently been found in Egypt. We have, therefore, some evidence—pretty good as these things go—for a definite connection through Egypt and Arabia with the North-West Provinces of India. The Cretaceous rocks, which have been proved by the existence of fossils, have been proved to come down from the south towards Bilma, north of Lake Chad. And one of the fossils, a fossil which was found by Colonel Monteil some ten or twelve years ago, was lying about for a long time till Prof. A. de Lapparent happened to catch a glimpse of it, and, recognizing its importance, had it described by a specialist in palæontology, who discovered that it was the same thing as a kind of sea-urchin which was found quite recently in Beluchistan, in fossils of Cretaceous age there. Here we have a proof of the connection of India and the Sahara in Cretaceous times as well as in the later Tertiary times. There is just one little interesting point here with regard to the theories of Prof. Suess. He has maintained that the raising of the sea-floor began in very old times, and that it went on continuously, and that the Cretaceous rocks were raised up soon after they were formed, so that the Tertiary rocks were always found, as it were, within the limits of the Cretaceous rocks. As we in England find the Chalk to the north of the London basin—further north than the London Clay, so here in Africa up to now they have found the Chalk south of the Tertiary rocks—that is to say, the

Chalk goes all round and the Tertiary rocks lie inside. The Chalk which underlies the Tertiary rocks was raised up while the Tertiary rocks were being deposited. Well, now, our facts at present are, thanks to Colonel Elliot and his associates, that we know the Tertiary rocks are further south than the Cretaceous rocks; that is to say, they are outside the supposed circle. What we have to do now is to find out whether the Cretaceous rocks do not occur further south still.* Otherwise, instead of this basin being raised up regularly, we shall have a sort of lop-sided arrangement; it will have been raised more on the north than the south. These are some general questions of very great interest, which arise out of just one simple point in the labours of this expedition. I may venture to speak just at present on behalf of my colleagues at the British Museum. We express our deep thanks to Colonel Elliot and his fellow-officers who have brought home these specimens, which are not so easy to collect as one might think, because of the great heat and the difficulty of getting them home, and have now presented them to the British Museum. You can see them in the adjoining room after the meeting.

The PRESIDENT: We must all have been struck with the great interest that attaches to Colonel Elliot's paper in various ways, more especially the discovery of fossils, the importance of which has been explained to us in such an interesting way by Mr. Bather. I would now propose a very cordial vote of thanks to Colonel Elliot for his interesting paper, and for the illustrations with which it has been accompanied.

A NOTICE OF SOME MARINE TERTIARY FOSSILS FROM NORTHERN NIGERIA, COLLECTED BY COLONEL G. S. McD. ELLIOT, R.E., AND CAPTAIN LELEAN, R.A.M.C., OF THE ANGLO-FRENCH BOUNDARY COMMISSION.

By R. BULLEN NEWTON, F.G.S.

BRITISH MUSEUM (NAT. HIST.).

SOME interesting marine Tertiary fossils have been recently presented to the British Museum by Colonel Elliot and Captain Lelean, who obtained them from Kalfu-Tamaské and Garadimi, in Northern Nigeria. A study of these specimens, which consist of molluscan remains and well-preserved Echinoids, undoubtedly confirms what has already been made known to us by Prof. A. de Lapparent,† as to the presence of Eocene (Lutetian) rocks in this part of the Sudan area of Africa. The material on which Lapparent based his conclusions was discovered by Captain Gaden at the same place, viz. Tamaské, 400 kilometres west of Zinder, and comprised the following shells and Echinoids, the latter having been determined by M. Victor Gauthier: **Mollusca**—*Nautilus cf. Lamarcki*, Deshayes. *Nerita* (*Velates*) *Schmideliana*, Chemnitz. *Lucina cf. gigantea*, Deshayes. **Echinoidea**—*Plesiolampas*, n. sp. *Linthia cf. Ducrocqui*, Cotteau. *Rhabdocidaris* (*Leiocidaris*).

* This supposition is now confirmed. The British Museum has recently received some Ammonites, Lamellibranchs, and other fossils, determined by Mr. G. C. Crick as of Upper Cretaceous (Turonian) age, collected by C. L. Temple, S. of Gongola, Bauchi Province, Northern Nigeria. (Note added, September 8, 1904.)

† A. de Lapparent, "Sur les traces de la mer Lutétienne au Soudan," *Comptes Rendus*, 1903, vol. 136, p. 1118; "Sur de nouveaux fossiles du Soudan," *Comptes Rendus*, 1903, vol. 136, p. 1297.

Besides finding such fossils at Tamaské, Captain Gaden also noted their occurrence at different points of the country between that place and Chad, notably at Zinder and in the Damergou, situated to the south of Air. M. Douville, who had examined the *Nautilus*, regarded it as closely allied to *N. Lamarcki*, from the "Calcaire Grossier" of France, whilst M. Victor Gauthier was equally certain that the Echinoderms exhibited a Middle Eocene or Lutetian facies, the examples of *Linthia* being difficult to separate from Cotteau's *L. Ducrocqui* found in limestones of that age at Saint Palais (Charente-Inférieure), France.

The same Lutetian or middle Eocene aspect characterizes the fauna represented in the collection made by Colonel Elliot and Captain Lelean. Among the shells being the following forms: **Lamellibranchia**—*Ostrea cf. rarilamella*, Deshayes. *Alectryonia cf. Martinsi*, Archiac. *Vulsella Nigeriensis*, n. sp. *Spondylus cf. subspinosus*, Archiac. *Cardium*, sp. *Lucina cf. Menardi*, Deshayes. *L. cf. pharaonis*, Bellardi. *Lucina*, sp. indet. *Panopæa Sahariensis*, n. sp. **Gastropoda**—*Calyptræa Nigeriensis*, n. sp. *Volutilithes cithara*, Lamarck. *Rostellaria cf. goniophora*, Bellardi. *Turritella cf. Ægyptiaca*, Mayer-Eymar. *Conus*, sp.

Some of these specimens are preserved as limestone casts, among them being several *Lucina*, which I have called *L. cf. Menardi* and *L. cf. Pharaonis*, and which represent, most probably, the forms referred to in Lapparent's paper as *L. cf. gigantea*. All three species, however, are typically Eocene, and have mostly been recorded from Egypt or southern European countries. The specimens of *Alectryonia cf. Martinsi*, originally described from India by J. de C. Sowerby under the name of *Ostrea orbicularis*, helps to support the theory that this ancient sea had an extensive eastward direction in Eocene times. The peculiar ostreiform genus *Vulsella* may also be referred to as characteristically Eocene, whilst among the Gastropods *Volutilithes cithara* is important from the distribution point of view being known from the Eocene areas of England, Europe, Egypt, and India.

The Echinoids of this collection evidently represent much the same forms referred to in Prof. de Lapparent's paper, but no further mention need be made of them on this occasion, as Dr. F. A. Bather is now preparing a detailed account of them for future publication.*

Fragmentary Foraminifera have been observed in microscopical sections of the limestones, the prevailing organism being *Operculina*, no Nummulites being observed.

Further Eocene areas in African territory north of the equator may now be briefly alluded to. Dr. Paul Oppenheim † has published a list of fossil marine shells collected by Dr. Esch in the Cameroons, which he regards as of Lutetian age, on account of the species characterizing beds of that age in the Paris basin. His determinations are as follows: *Cytherea nitidula*, *C. elegans*, *Tellina subrotunda*, *Sycum bulbiforme*, Lamarck.

Eocene rocks are again met with westward of the regions already mentioned. Prof. G. Vasseur ‡ having reported the occurrence of *Nummulites Gizehensis* of the *N. Ehrenbergi* group, which were obtained from a boring at a depth of 230 metres at St. Louis, in Senegal.

In the more northern and eastern parts of the African continent, similarly aged

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* Since the present notice was written, Dr. Bather's paper has been issued under the title of "Eocene Echinoids from Sokoto" (*Geological Magazine*, 1904, plate xi., pp. 292–304), containing figures and descriptions of *Plesiolampas Saharæ*, n. sp., and *Hemiaster sudanensis*, n. sp.

† Paul Oppenheim, "Vorläufige Mittheilung über das Auftreten von Eocän in Kamerun," *Centralblatt Mineralogie Geol. Pal.* (Stuttgart), 1903, No. 12, pp. 373, 374.

‡ G. Vasseur, "Sur la découverte du terrain nummulitique dans un sondage exécuté à Saint-Louis du Senegal," *Comptes Rendus*, 1902, vol. 134, pp. 60–63.

rocks are also largely developed, extending from Morocco to Egypt, and including a fair area of the plateau limestones of Somaliland. In fact, the palæontological evidence seems to prove that the greater part of the country above the equator was covered by this ancient sea during the Eocene period of its history.

Besides the occurrence of this Eocene fauna, it may be of interest to mention that there is palæontological proof of the former existence of a still more ancient sea, marine Cretaceous fossils being also known in the Sudan area of Africa. Prof. A. de Lapparent * has published a notice of an echinoid which had been collected by Colonel Monteil between Chad and Bilma. This specimen was identified and described by M. Victor Gauthier as *Noetlingia Monteili*, a form showing affinities with *N. paucituberculata* from India, and therefore considered to be of Maestrichtian or Upper Aturian age. Further, Captain Gaden, on the authority of Prof. A. de Lapparent,† was fortunate in finding an Ammonite and an *Exogyra* in Upper Cretaceous beds at Damergou, between Zinder and Aïr. This Ammonite, according to Munier-Chalmas, shared characters with the Turonian genera *Mammites* and *Vascoceras*, both of which are found in the rocks of Tunis, Algeria, Portugal, and Spain. Ammonite impressions had been previously referred to by Rohlfs ‡ as occurring in a sandy matrix between Aghadem and Bilma, but without a definite statement as to their geological horizon.

THE SCIENTIFIC RESULTS OF DR. SVEN HEDIN'S LAST JOURNEY.§

By Dr. SVEN HEDIN.

THE four final decades of the nineteenth century may with justice be called the last phase of the great age of geographical discovery, for the only parts of the Earth's surface that remained unexplored at the dawn of the twentieth century were the poles and the circumjacent oceans. As for the continents, they are now well known, even in their interior parts, and all that remains to be done is to fill in details. Asia was, however, the most difficult to be subdued, and I account it an honour to have been allowed to lift the veil off some of its geographical secrets, and to have been one of the latest pioneers in Asiatic discovery. That continent is being made known at a rapid rate. A country like Tibet, which has slumbered for thousands of years in the arms of the highest mountain ranges on the Earth, was even yesterday a *terra incognita*, while to-day it is traversed by armies trained and led by Europeans.

My last journey occupied me from June, 1899, to June, 1902. The first year after my return home was spent in preparing a popular

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* A. de Lapparent, "Sur la découverte d'un Oursin d'âge Crétacé dans le Sahara oriental," *Comptes Rendus*, 1901, vol. 132, pp. 388–392.

† A. de Lapparent, "Sur de nouveaux fossiles du Sudan," *Comptes Rendus*, 1903, vol. 136, p. 1297.

‡ G. Rohlfs, "Reise durch nord-Afrika," etc., *Petermanns Geogr. Mittheilungen*, 1868, supplementary part, No. 25, p. 40.

§ Map, p. 616. This map is given as a specimen of the atlas, and the spelling adopted by Dr. Hedin has been allowed to remain unaltered.

account of my travels, which appeared in several languages, as well as in delivering addresses before the most distinguished geographical societies in Europe. But as early as October, 1902, I petitioned His Majesty, Oscar II. of Sweden, for a public grant of money to enable me to publish the scientific results of my expedition. My request was referred by the Government to the Academy of Science in Stockholm, and the Academy appointed a committee of three members, consisting of Dr. E. W. Dahlgren, Prof. A. G. Nathorst, and Prof. Hj. Sjögren, who supported my petition, and in April, 1903, my request was granted by the Swedish Parliament. It is to the Parliament, therefore, that I in the first place owe my sincerest thanks, for having rendered it possible for me to publish the work in question; and I would also take this opportunity of expressing my thanks to the Swedish Minister of Ecclesiastical Affairs, Dr. Carl von Friesen, to Prof. Baron G. De Geer, as well as to Dr. E. W. Dahlgren, librarian-in-chief, whose counsel and assistance, coupled with their great experience, have been of the greatest possible value to me.

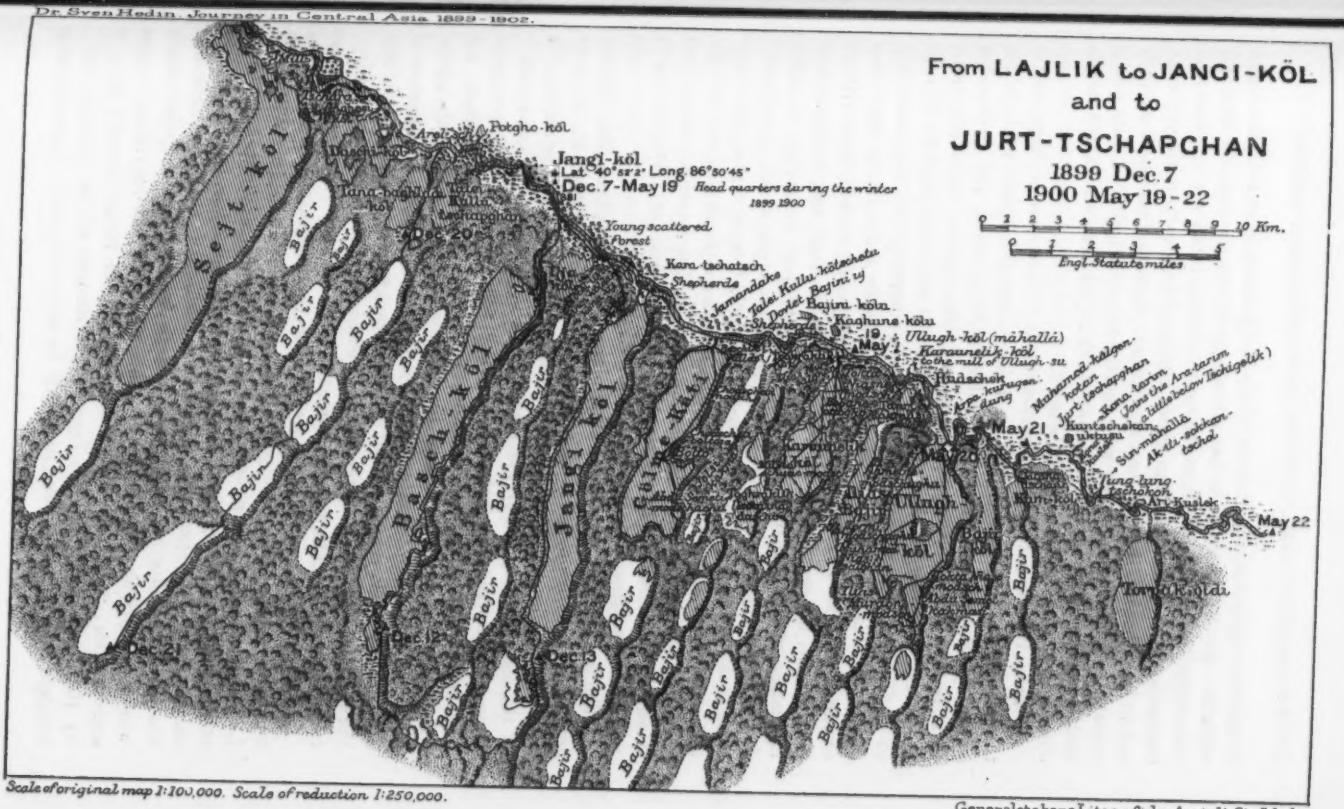
My object in the present paper is to give an account of the plan of this work, the manner in which it has been prepared and published, and especially of my own personal share in it—namely, the topographical map and the text dealing with the physical geography, which is so intimately connected with the map. I might, perhaps, call this paper, at one and the same time, a preface to the work and a criticism of it. I have thought it expedient to publish a preface in this way, because the preface proper cannot be printed until the entire work is completed and I am in a position to command a general view of the whole. My reason for printing this provisional preface—the final preface will be issued later on in a somewhat different form—is that students of geography may not be kept waiting for two years until the work is completed. With regard to the criticism, I am only too conscious of the defects in my work, and wish, therefore, to give here an idea of the *way in which* I worked in the field, and how, since my return, I have brought together and digested the material I collected. It is, however, a difficult task to write a criticism of one's own work; nevertheless, I will endeavour to be as just as I can.

The 'Scientific Results of a Journey in Central Asia, 1899–1902,' was planned to appear in complete form before the end of the year 1906. As far as my own purely geographical text is concerned, it will be ready to publish by the autumn of 1905; indeed, at the moment of writing, fully three-fifths of the whole is already in manuscript. In the prospectus which I printed in the beginning of 1903, a flyleaf of which was distributed with one of the numbers of the *Geographical Journal*, I undertook to prepare a map of my journey on the scale of 1:100,000 and 1:200,000, in a hundred sheets, making an atlas of two folio volumes, and this was to be accompanied by 800

pages of text, illustrated by 500 cuts and various smaller maps. The other scientific results, collections, and different series of observations were to be dealt with by specialists. The text altogether was estimated to fill four or five volumes, and the edition was to consist of 250 copies at the price of £15 sterling.

Before very long, however, I perceived that the limits appointed were insufficient. No change will, however, be made with regard to the dissertations of my colleagues; but in the case of my own purely geographical work, I am driven to the necessity of making a very appreciable addition: instead of one volume of 800 pages, it will extend to four volumes of about 2000 pages in all. The first volume, now published, contains alone the 500 illustrations promised, and each of the three succeeding volumes will be just as profusely illustrated, with the possible exception of the second. Similarly, the atlas will in all probability extend to 120 sheets instead of 100. Nevertheless, after consultation with Dr. Dahlgren and my publisher, Mr. A. Lagrelius, I have resolved not to raise the price, despite the fact that the cost of the entire work will be very materially increased; indeed, the 75,000 kronor granted by the Swedish Parliament will be insufficient to cover it. The price, therefore (£15), is unusually cheap for a publication of this character. In view of the smallness of the issue and the low price, I would recommend those who are interested, and desire to have a copy of the work, to subscribe without delay. My reason for mentioning this is that even before the preliminary announcement of the work, a great number of copies were already ordered. And it may not be altogether without interest just now, that the first two subscribers to be enrolled hailed from Japan, namely Count Otani and the Geographical Society of Tokio.

I will say but a few words with regard to the treatises of my colleagues, for the purpose of this paper is to deal more particularly with the geographical side of the work. Volume v. will consist of two parts, one containing the meteorological observations, the other the astronomical. The former is dealt with by Dr. Nils Ekholm, and will embrace two divisions—the first, the series of actual observations themselves, will be published at the end of the present year; the second, the scientific discussion, in the spring of 1905. This part of the work promises to be rather voluminous, for it embraces observations made three times a day over a period of six years, for the meteorological results of my 1894–97 journey are also included. Moreover, for a period of more than one year the observations are double; that is to say, one series was taken by myself whilst on excursions, and another series at my fixed headquarters. The tables will also give the latitudes and longitudes of the several places of observation, with the possible exception of those in the Eastern Pamirs, this exception being due to the fact that the cartographical material which I brought home with me


Dr. Sven Hedin. Journey in Central Asia 1899 - 1902.
From LAJLIK to JANGI-KÖL
and to
JURT-TSCHAPCHAN
1899 Dec. 7
1900 May 19 - 22
Jangi-köl
Lat. 40° 55' 2" Long. 86° 30' 45"
Dec. 7 - May 19
Head quarters during the winter 1899 1900
Dec. 20
Young scattered forest
Kara-tschatsch
Shepherds
Tamandaks
Tale. Hallu-kölcheku
Bajini uj
Bajini-köla
Kaghuna-kölu
Shepherds
19 May
Ulugh-köl (mähallä)
Kuraunelik-köl
to the mill of Ulugh-su
Hindscheh
Mahamed-kolgan
kodan
Jurt-tschapchan
Kona-tarim
(runs the Ara-tarim
a little below Tschigelik)
May 21
Kuntschekan
Ukuyu
Sin-mähallä
Ak-tti-sokkon-
tschol
Tung-tung
Tschokon
Ara-Kunlek
May 22
Tarim-köldi
May 20
Ulugh-köl
Bajir-köl
Dec. 21
Dec. 12
Dec. 3
Bajir
Lop-Nor
Jangi-Köl
Bagchi-Köl
Scale of original map 1:100,000. Scale of reduction 1:250,000.
Generalstabens Litografiska Anstalt Stockholm

from those regions on the occasion of my last journey have not yet been reduced. Dr. B. Hassenstein had already made a beginning and drawn the outline of the map when, to the sincere sorrow of all who appreciate the cartographical work of the great Perthes firm, death put a sudden end to his labours. I have, however, reason to hope that the map in question, the Eastern Pamirs, will shortly be published in *Petermanns Mitteilungen*, possibly in time to allow of the requisite co ordinates being obtained to complete Dr. Ekholm's work.

I trust it will not appear presumptuous if I venture to hope that the meteorological material which I have brought home with me, extending as it does over such a relatively long period, and gathered as it is from parts of the world that are little known or, indeed, are absolutely unknown—that it may possess some real value, and fill a gap in our meteorological and climatological knowledge of the interior of the Earth's greatest continent. Dr. Ekholm's discussion may be expected to throw light upon several phenomena connected therewith; for instance, the occasion of the inconceivable violence and remarkable constancy of the east-north-east winds that blow in spring in the Lop-nor country and adjacent desert regions—winds which have had most to do with determining the configuration and physico-geographical and morphological features of that part of the continent; as well as to throw light upon the laws governing the not less constant westerly wind, which in winter blows throughout the whole of Tibet, and its possible connection with the monsoons.

The materials of my astronomical observations have been dealt with by Dr. K. G. Olsson, working under the direction of Prof. Dr. P. G. Rosén. Dr. Olsson has expressed himself as satisfied with the accuracy of the observations, and of the results which have been deduced from them. It is self-evident that the value of the 113 observations vary. The best are those which were taken at my headquarters, where I was able to repeat them several times; this enabled me to obtain also a valuable means of controlling the accuracy of my chronometers. Dr. Olsson's work, which will likewise embrace a scientific discussion of the material, is already three parts finished, and is intended to appear towards the end of the present year.

Vol. vi. will embrace descriptions of the collections I brought home with me. The first part of this, namely, Prof. Dr. Wilhelm Leche's account of the zoological collection, has already appeared. It consists almost entirely of skeletons and skins of mammals, but embraces only a very few specimens of reptiles, fish, and *Crustacea*. Small though this collection is, it may not be without interest, and the words with which Dr. Leche opens his paper may be regarded as an anachronism: "Only the most interesting of the forms brought home by Hedin are mentioned in Prjevalsky's account of his travels, but hitherto they have not been discussed by any zoologist." I grant that

specimens of the forms alluded to have already been brought home by Russian travellers; but if they have never been studied by a specialist, they might as well still be in the deserts and mountains of Central Asia as be put away and forgotten in the museums of St. Petersburg. Prof. Leche's essay will be accompanied by eighty excellent illustrations in the text, and by five copper plates representing mounted skeletons of *Camelus bactrianus ferus*, *Equus Kiang*, *Bos grunniens ferus*, *Ovis Ammon*, and *Ursus pruinosus*. Travellers who are trained zoologists as well will no doubt regard this little collection with a certain degree of contempt, and reproach me for not having taken greater pains to augment it. To any such hypothetical reproach I can only reply that zoology does not belong to my special field of labour, and that I made this collection more to gratify my own pleasure or fill an idle hour than with the view of satisfying the demands of the zoological specialist; and if I were maliciously inclined I might proceed to ask my critic a question or two about the geographical and cartographical materials he brought home with him when he was travelling for specially zoological purposes. In general, I have made it a rule to stick to my own special sphere of work, namely, geography and map making, in which I am at home. The material, therefore, which I offer in vol. vi. is of necessity defective, and always occupied a secondary consideration in my regards. It is impossible for one man to be master of everything. It must also be remembered that the skeletons and other parts of my collections had to be carried thousands of miles through Asia, being day after day loaded up on the backs of camels and unloaded again, very often under accompanying circumstances of the most unfavourable character.

The same remarks apply to the botanical collection: it is very small, and was gathered by a "layman" who has no idea of botany, and plucked his flowers *en passant*. The collection, such as it is, is being dealt with by Prof. Dr. G. Lagerheim, who is now engaged upon it, though he has handed over certain sections to other specialists, *e.g.* the *Algæ* to Prof. Dr. Nils Wille.

The geological collection consists of about seven hundred specimens, and is being dealt with by Dr. H. Bäckström and other geologists. I have, however, thought it expedient, in my geographical account of Tibet, to mention briefly the varieties of rock I observed in crossing the several mountain ranges. As, however, the identifications rest solely upon a superficial macroscopical observation, they do not possess more than a general value, and require to be completed by the more minute microscopical investigations of specialists. A number of specimens of sand, and various kinds of soil and salt, have been examined by Prof. Baron De Geer, assisted by Mr. G. Aminoff.

To all these gentlemen, who have so readily and so disinterestedly undertaken to throw the light of their special experience upon the

small contributions which I have been permitted to make to the great whole of scientific knowledge, I desire to express herewith my hearty and sincere thanks. The reason I do not include amongst them the scholar who so kindly undertook to deal with the archæological material of my journey, namely, Herr Karl Himly of Wiesbaden, is that no thanks of mine, however deep or however heartfelt, can any longer reach him, for he died on June 1 in the present year, the same day that I received the first proof of his essay, "Die Ausgrabungen am alten Lop-nur." Heavy though this blow is to me, it is nevertheless small as compared with the loss suffered by Germany and science, for of sound sinologues we have not many, and of those we have, Himly was undoubtedly one of the most distinguished. I did not know him personally; I only knew him through our active correspondence since the year 1898, when he helped me in my investigation of the Lop-nor problem, and assisted me in the preparation of my monograph in *Petermanns Mitteilungen*, Ergänzungsheft No. 131; but I look upon him as an old friend. He was a quiet, industrious, conscientious worker, who had no love for self-advertisement, but was ever ready to place his learning, and his deep and thorough acquaintance with ancient Chinese documents, generously at the disposal of others.

When Himly died, the greater part of my archæological collection was in his hands, with the exception of the heavy sculptured beams, though of these I sent him photographs. From the letters I received from him, I can readily see that his work promised to be of the greatest importance and value, and that with the assistance of the Chinese manuscripts that I discovered at Lôu-lan he would have been able to shed light upon many hitherto obscure problems. Unfortunately, he did not live to complete more than an extensive introduction and the first chapter, which he entitled "Chinesische Karten der Westlande." I do not know whether he drew up any outline of the chapters that were to follow, but there is no doubt whatever that he had the plan of the whole clearly arranged in his own mind. I hope, however, that I shall succeed in finding a scholar to complete the work which Himly so ably began.* I venture to quote the opening words of his introduction, for they convey an idea of the importance of the problem he had to deal with: "Of the ruins of ancient cities which have recently been visited and explored by travellers in East Turkestan, those which Dr. Sven von Hedin brought to light in the supposed ancient bed of the Lop-nor have been not the least fruitful in their results for science. Amongst other things, he discovered tablets of tamarisk wood covered with Chinese script, similar to those which Stein dug out in 1899 at the

* I am glad to say that Prof. A. Conrady in Leipzic has been kind enough to complete Himly's work. Prof. Dr. Hj. Stolpe in Stockholm will describe my collection of terra-cottas from Khotan.

Niya river; further, several written fragments of old papers of different kinds, and letters on wood, of the same kind as those illustrated in Stein's 'Preliminary Report.' On several of these tablets, wooden letters, and scraps of paper we find the name of the ancient kingdom of Lôu-lan. That this ancient state was situated on Lop-nor we know from one of its old names, *e.g.* Lao-lan-hai, or Lôu-lan-hai."

Yes, Himly's work would have furnished an historical and ethnographical proof that the solution of the Lop-nor problem at which I had arrived upon purely physico-geographical grounds is sound and definitive. Himly had already selected from the materials I placed at his disposal the manuscripts and other objects which he wished to use in illustration of his text, and they have been photographed by his brother, Captain Eugen Himly, and will be published, together with the completed text, in the 'Scientific Results.'

I now pass on to the atlas, the *pièce de resistance* of the entire work. My original map consists of 1149 sheets, the length of the actual red-lined itinerary on which amounts to nearly 1000 feet, though the distance actually travelled was over 6200 miles. The scale varies, being on the whole 1 : 30,000 to 1 : 40,000, and reproduces the morphological characteristics in the minutest detail. My field instruments were a chronometer and a compass; by the latter I determined the direction, taking numerous observations, sometimes as many as two hundred in a day, and by the former I measured the distance. I must add that I always kept a check upon the rate of movement. This method may appear very simple, but it has, at any rate, yielded amazingly accurate results. With help of this method, *i.e.* this topographical apparatus, I would venture, starting from any fixed astronomical point, to make a traverse to any other known point you please, and at almost any distance. In other words, I have the most absolute confidence in the accuracy of my method, *i.e.* on the assumption, of course, that the distance is always calculated with the greatest accuracy, and base-lines are measured every day for the control of the rate of speed or velocity. In general, the results obtained on land are better than those obtained on water, although the safest of all are those got in calm weather on stationary water. But when a river is used for motive power, the calculation of the distances is never so reliable, owing to the continual variation in the velocity of the stream, and the difficulty in most cases of measuring its amount with sufficient frequency. This is especially the case where the velocity is great, and the current carries the means of transport along with great rapidity. In general, the distance under such conditions tends to come out too short.

I cannot here give a detailed account of the devices I adopted for indicating the various different features of the country travelled through. All the land-maps of my journey will be published on the scale of 1 : 200,000, except that of the route from Kashgar to Lailik,

which is on the scale of 1 : 100,000. My original drawing is, therefore, so reduced in scale that a great part of the finer details are necessarily lost. This is, indeed, very much to be regretted, especially as several judges, including Lord Curzon, to whom I showed about a hundred of my sheets in Calcutta, expressed the opinion that the maps ought to be published on the scale to which they were originally drawn; but, on the other hand, there are great difficulties, both practical and financial, in the way of issuing a considerable atlas on a larger scale than 1 : 200,000. It is, therefore, the maps of the Tarim river only that are issued on the scale of 1 : 100,000. At the same time, with the view of giving some idea of the methods I employed in depicting the features of the country I travelled through, I have included in the atlas a number of the original sheets in facsimile, selected from different parts of the interior of Asia. This will also afford the student an opportunity of comparing the original work with the map that has been constructed upon it. In this way my own hand-drawn maps, which took three years of strenuous labour and unintermittent attention, will not disappear entirely in the printed maps, but will also remain, at any rate in part, as evidence of the work I accomplished.

In the labour of reducing, reconstructing, and drawing for the purposes of reproduction, I have had the great good fortune to find exceptionally skilful and experienced colleagues in Major H. Byström and Lieut. O. Kjellström. As a model we have followed in this respect the large atlas, on the scale of 1 : 200,000, which Dr. B. Hassenstein drew to accompany the account of my former journey, and of which six sheets were printed on a reduced scale in *Petermanns Mitteilungen*, Ergänzungsheft No. 131. Owing to Herr Perthes' courtesy, I have been allowed to borrow this atlas for the time being. I think it but just to my colleagues to say that the results of their labours will bear comparison with the best work of the kind that has been produced outside of Sweden. A glance at the first sixteen sheets of the published atlas will convince the expert that my words are no exaggeration. Of these sixteen sheets all have been constructed by Major H. Byström, and twelve have likewise been drawn by him; the other four are drawn by Lieut. O. Kjellström. In addition to these, twelve other sheets are ready, and will be published in the autumn, while my two colleagues, whose industry is as admirable as their skill, are busily engaged upon the rest. Owing to his long and great experience, Major Byström was able, as early as the summer of 1902, to draw up the plan of the entire atlas, to determine its size and the method of reproduction, as well as to select the many technical devices which are necessarily required in a work of the kind, and the atlas was then and there begun.

In addition to these sixteen sheets, which embrace my Tarim journey as far as Yanghi-Kul, the Cherchen desert, and my journey to Bostan-toghrak, we are now publishing six sheets in facsimile. The atlas

proper is estimated to contain about eighty-five sheets, fifteen or sixteen of which will be on the scale of 1 : 100,000, and all the rest 1:200,000. Meanwhile, with the view of making the cartographical material more accessible, as well as to facilitate a general view of the entire region traversed, we did at one time contemplate incorporating in the atlas a general map in four sheets on the scale of 1:2,000,000. But further reflection has convinced me that, in view of Penck's proposal to prepare a map of the entire Earth on the scale of 1:1,000,000, it would be more expedient to publish the general map on the scale of 1:1,000,000 and in sixteen sheets. Another advantage attaching to this change of plan is, that the substituted map would be drawn on the same scale as that which Hassenstein prepared after my former journey. The new general map would embrace the whole of the material used by Hassenstein, together with as much as possible of the results obtained by other travellers. In a word, it would reproduce *everything* we know down to the present date about the geography of Central Asia. For the preparation of such a map, which will of course entail incomparably greater expense and involve more labour than a general map in only four sheets, I hope to be able to draw upon the experience, as well as upon the collection of materials in the hands of Justus Perthes' Geographische Anstalt, for it is only there that a map of this magnitude could be produced. I should be glad to learn that the plan of a map on this scale meets with the approval and moral support of geographers, a support which may legitimately be asked for before such a costly step is finally taken.

Thus the atlas and general map together will make in all about 100 sheets. In addition to these, there are about a score of sheets in facsimile, forming an independent series, numbered with Roman numerals. These sheets are selected with the view of giving an idea of different types of conformation, with all the natural details that belong to them. The six sheets now issued reproduce in this way very different parts of the Tarim. From these, and in a still higher degree from those sheets which represent the mountainous parts of Tibet, the reader will be able to see to what extent the details originally incorporated have become lost in the process of reduction.

But there exists another practical reason for the publication of these facsimiles, namely, the hope that they may be of assistance to younger explorers who may follow after me. Moreover, I venture to hope, also, that my atlas may serve as a guide, which, although costly, will be practical and useful, to the first preliminary mapping of an unknown country.

In this connection I would also desire to express publicly my hearty thanks to Major H. Byström and Lieut. Kjellström for their very excellent technical work, and for the pleasure it has given me to labour in conjunction with them; for I have, of course, to superintend their labour and to be responsible for it.

It only remains that I should give some account of my own text, first indicating in a few words the way in which it is divided and arranged, and then adding a sentence or two by way of criticism.

The text will embrace four volumes—Vol. i. The Tarim River; vol. ii. Lop-nor; vol. iii. Northern and Eastern Tibet; vol. iv. Central and Western Tibet. The little vignette map is intended to give a bird's-eye view of the distribution of the geographical material.

For purely practical reasons I have written the original in Swedish: one naturally writes with greater freedom, as well as more rapidly, in one's own mother-tongue than in a foreign language. At the same time, I was fully convinced from the very beginning of the absolute necessity of publishing the work in one of the three great world-languages, and after consultation with Dr. Dahlgren I selected English, not only because it is the most distinguished, but also because it has the widest circulation, and consequently we might hope that the work would secure the largest number of subscribers in Great Britain, the United States, and India. My manuscript has therefore been translated, and I have had the good fortune to find in Mr. J. T. Bealby, B.A., of London, an excellent translator, almost as well versed in Swedish as in his native tongue, who, moreover, has had the advantage of a long acquaintance with my style, for it was Mr. Bealby who translated 'Through Asia,' and 'Central Asia and Tibet.' Mr. Bealby is, moreover, a man of great learning and many-sided culture, and has had considerable experience in translating for the *Geographical Journal*. I feel confident, therefore, that the English of the 'Scientific Results' does full justice to the original Swedish, and I owe Mr. Bealby many and sincere thanks for his conscientious and unwearied labour. With the view of guarding against possible misunderstandings on the part of the translator, I may add that I have myself read two successive proofs of the whole, comparing the translation word for word with the Swedish original, and I hold myself responsible for the matter in the fullest acceptation of the term, as well as for the numerical data, geographical names, etc., etc. Mr. Bealby has also read two successive proofs, and is responsible for the orthography and style of the English. Any errors that may have escaped our conjoint vigilance must be set down as misprints. Dr. K. B. Wiklund also read a proof of the first half of the first volume, but unfortunately was unable to continue owing to illness, and I have taken it upon me to complete his work.

By the express wish of Dr. E. W. Dahlgren, I applied to Dr. K. B. Wiklund, Lecturer in Finnish-Ugrish Philology at the University of Upsala, with the view of securing a consistent orthographical system in the writing of the geographical names, and found in him the first authority in that particular field that Sweden possesses. At a later stage Dr. Wiklund will himself explain his system; here it will suffice if I point out one or two of its salient features, which it will be

important, especially for English-speaking readers, to bear in mind. For instance, Dr. Wiklund writes *tsch* instead of *tj*, *dsch* instead of *dj*, *ch* instead of *kh* (*sch* instead of the English *sh* and French *ch*), *gh* in words with open vowels, *g* in words with closed vowels, as well as in general reducing the vowels to conformity with the pronunciation employed for the language of East Turkestan in Radloff's Dictionary —that is, as far as it has appeared. Dr. Wiklund tells me, however, that in several cases he has not been quite consistent, but has varied his practice, especially in the employment of *e* and *ä*. He finds that my transcription of these sounds is erroneous—a consequence, in part, of my being a native of Stockholm, to whom the difference between *e* and *ä* is not very distinct. He also considers that it is in part due to the fact that I have often taken the unaccented syllable *a* for an *e*—a common mistake in the case of an ear that is not phonetically trained. He also suspects that I have sometimes mistaken an *i* for an *e*. For these reasons Dr. Wiklund has felt it expedient to depart from strict consistency, and has not written all my *e*'s as *ä*'s, for by so doing a number of *ä*'s and *i*'s would have been incorrectly transcribed. He has therefore confined himself to writing *ä* where he has been able to find the word in the dictionaries, and ascertained that in the book language of East Turkestan the vowel has the sound of *ä*. For instance, he has written my *besch* (= "five,") and *seksan* (= "eighty") as *bisch* and *siksan*, both to bring them into conformity with the literary language and to avoid the multiplication of dialectal forms. For the same reason he has often altered the genitive termination *-ne* into *-ning*, although in certain characteristic words we have resolved, after consultation together, to make no alteration. Consequently, in the text, as well as in the atlas, both these terminations will be found, to say nothing of several other genitive suffixes that are characteristic of the Lop country. In certain words we have not slavishly followed the orthography of the literary language, but have preferred to retain the dialectal differences. For instance, the word *jarsik* (= "river lagoon") we have often written *jasik*, *jarsuk*, and *jasuk*. It has, however, been very difficult to discriminate consistently between *gh* and *g*. The general rule laid down above is not, on the whole, difficult to follow; but, on the other hand, it is uncertain whether *i* ought to be regarded as an open or a closed vowel. For this reason we have written both *igis* and *ighis* (= "high"). But in the case of a word like Ugen-daria the uncertainty is even greater. "What is the value of *u* in this word?" asks Dr. Wiklund. "Is it the Swedish *u*, resembling the sound of *y*, or is it the European *u*? In other words, ought the word to be written *ugen* or *ughen*?" The question cannot be decided; accordingly, I have preferred to keep to *Ugen*-daria, the form adopted in *Petermanns Mitteilungen*, Ergänzungsheft No. 131.

Generally, Dr. Wiklund has abbreviated the long intervocalic consonants, though not always, because, as he justly observes, the

double forms *may* be found in the dialects: thus he writes *attam*, and not *atam* (="my father"). With regard to the word *Muhamed*, it is sometimes written with a double *m*, although that is an incorrect form. In the second half of the first volume certain violations of the rules of the system as here laid down are entirely due to my fault, owing, as I have said above, to Dr. Wiklund's illness and my having to continue his work single handed before I had acquired complete mastery of it. The spelling *sogot* for *soghot* in two or three places is a pure mistake. I have preferred the old spelling Ettek-tarim instead of Ätäk-tarim, although the latter would have been more consistent. In the discussion at the end of vol ii., in which Dr. Wiklund deals with geographical names, as well as with the system of transcription adopted, any errors of this kind will be corrected. Small inconsistencies that we have been unable to avoid altogether are, of course, of less importance from the geographical than from the philological point of view.

I need hardly say that in the 'Scientific Results' I have used exclusively the metric system, as well as the thermometric scale of my countryman Anders Celsius, professor at Upsala; and it is not my fault if the conservatism of the English-speaking world makes these two systems less familiar than they ought to be to the readers of the book.

And now to come to my text. All I claim for my work is that it amounts to "Begleitworte zu den Karten;" in other words, it is an explanatory text to the atlas, and its contents are purely physico-geographical, forming a topographical, morphological, hydrographical, and orographical description of the regions traversed. The reader will in vain look for any new strokes of genius or epoch-making ideas of a similar character to those in Richthofen's 'China,' or Peschel's 'Neue Probleme.' What I am in a position to offer to geographers and serious students of geography is only a faithful geographical description, rather dry, but rich perhaps in new facts and geographical discoveries. For this reason I have arranged my text in diarial form, recording each day the observations made, so that in this way the text furnishes a detailed commentary, day by day and sheet by sheet, to the maps in the atlas This has rendered my task easier and readier of accomplishment, and the connected study which, with the help of Supan's 'Physische Erdkunde' and certain other text-books, I made whilst the journey was in progress, is thus reproduced in my book in its natural order and sequence of development. Possibly this chronological arrangement will occasion the reader some difficulty, and make the 'Scientific Results' an unmanageable work of reference; and the fact that the first volume, now published, contains no index, is perhaps calculated to emphasize these drawbacks. This defect will, however, be made good in due season. The first and second volumes, which treat of the geography of East Turkestan, are so intimately connected that I thought it best to give them one common index or rather two indexes,

which will be printed at the end of vol. ii. The first, containing a list of all the geographical names that occur in the two volumes, will be prepared by Dr. Wiklund; the other, an index of the contents and matters of fact, will be compiled by Mr. Bealby.

The reader of vol. i. will no doubt be astonished at not finding a single quotation in its 512 pages. It is nowadays esteemed a merit to overload a scientific work with quotations of every sort and degree: they are a proof of wide reading and learning. I confess at once that I can lay no claim to either of these qualifications; and I trust the impartial reader will find excuses for me when I say that, having spent a large part of my life in travel, I literally have *not been able* to keep up with the progress and development of geographical study in other parts of the world, and still less with the faithful but laborious results of arranging and cataloguing which learned armchair geographers so unwearyingly carry out. I willingly admit that it is with a certain amount of respect I turn over the productions of stay-at-home scholars; but I must say that I prefer a thousand times to turn over the great open book of Nature, and especially those parts of it which have not yet got stowed away in any library. Whilst engaged on my journeys, it will be perfectly evident that I have not many spare minutes for reading; and since my return home the preparation of my observations for publication has claimed the whole of my time, to say nothing of the immense amount of labour involved in controlling the whole, in replying to the innumerable questions of those who are co-operating with me, in keeping an eye day by day upon the preparation of the maps, and in reading through piles of proofs, and, lastly, in using my further "leisure" to continue my own proper work. Under these circumstances I have found it impossible to do anything in the way of comparative geography, having found quite enough to do to write down, without comment and without ornament, the bare story of my own independent observations. The comparative discussion I leave to scholars at home, whose time is not taken up with the actual work of exploration. And when it is remembered that I have always worked alone, without any European colleague or assistant, and that the materials which I have collected have often been brought together under extremely difficult external conditions (of which I have given an account in my book 'Central Asia and Tibet'), the reader will, I trust, be willing to acknowledge that I have tried to do my best. In the second volume, however, the reader will find a number of comparisons and quotations bearing upon the sandy deserts and their origin, as well as upon the formation and movement of the dunes, drawn almost entirely from the works of Russian travellers in Asia—works which are in great part inaccessible owing to the general unfamiliarity with the Russian language.

From what I have already said, the reader will see that I have not

bound myself by other authorities, and have not slavishly followed the views and conclusions of other explorers, but have recorded my own independent observations, just as I made them, and give them for whatever they are worth. Direct observations always have a positive value; as for discussions about cause and effect, the reader can accept whatever he thinks well and reject the rest. Some of the theories I put forward may possibly appear too bold, but they embody, at any rate, my own convictions.

Vol. i. is entitled 'The Tarim River,' and consists of four principal sections—the Tarim River, the Lakes beside the Lower Tarim, the Cherchen Desert, and the Tarim Delta, divided into thirty chapters. In brief, vol. i. deals with the Tarim system from Lailik all the way to Abdal, together with that part of the great sandy desert that is situated between the lowermost Tarim and the Cherchen-daria. Vol. ii. is concerned with the Kara-koshun, the Kuruk-tagh, a part of the desert of Gobi, the desert of Lop, and above all the former Lake of Lop-nor and its history. This arrangement of the subject may perhaps strike the reader as incongruous, in that the description of the Tarim system is interrupted by the account of the desert of Cherchen. The reason is that I desired to discuss the desert lakes of the Tarim immediately after describing that river, for the two are inseparably connected, and this necessitated my giving an account of the *bajirs* of the desert of Cherchen in close connection with them, for the two phenomena, the lakes of the Tarim and the *bajir* depressions, are intimately associated. In consequence of this, vol. i. swelled out to such dimensions that there was no room in it for the Kara-koshun, which is, of course, quite as closely connected with the Tarim as any other of its lakes. To describe the Kara-koshun without reference to the Lop-nor problem would be absolutely impossible. I had, therefore, to abandon my original plan, by which vol. i. was intended to embrace the Tarim system and its terminal lake, while vol. ii. was to deal with the adjacent deserts and the problems they suggest. However, with the idea of furnishing a general view of the Tarim system, vol. ii. contains, first of all, a review of the entire river system, with illustrative maps in the text, as well as bathymetrical and other measurements.

Hydrographical specialists will probably be disposed to accuse me of dwelling on matters of too elementary a character, when I give the variations of the river at different seasons, the phenomena connected with its erosive energy, its alluvia, and so forth; but, as I have remarked above, I have written down my own observations, no matter what their value and significance, and they possess at any rate this merit—that they will at least confirm observations which have been made scores of times before.

Vol. i. is profusely illustrated. It contains 448 cuts in the text,

39 lithographic plates, and 17 maps and vertical sections. The autotypes consist for the most part of reproductions of my own photographs; in addition to them there are a number of drawings by my own pencil, which of course make no pretensions to artistic excellence, but all the same serve the purpose of illustrating the text. Of the cuts in the text, 95 consist of vertical sections or profiles through the Tarim and its tributaries, showing the depth, breadth, and velocity. Dr. N. Ekholm explains, in a couple of pages, the method he has employed for calculating the volume from the material thus supplied. From the observed velocities—that is to say, the river's fall, he has obtained also the means of determining the absolute altitudes, or rather the means of controlling the results furnished by the boiling-point thermometers, the aneroids, and the barometers. A special chapter of vol. ii. contains a list of absolute altitudes for the basin of the Tarim, and for defining the shape of the basin as a whole. These have been deduced by Dr. Ekholm from the absolute altitudes I have supplied to him.

The full-page lithographic plates have been executed by Lagrelius & Westphal of Stockholm, being reproductions of my negatives taken on Edwards's plates. All the large photographs were taken with a camera by Watson of London, and about a thousand of the small photographs on glass were taken with a Richard's Verascope camera. Both these cameras yielded excellent results; but for the future I shall fight shy of Eastman's Kodak, for it was only exceptionally that my Kodak yielded passable results. Fortunately, my supply of glass plates was so great that even in these four volumes I have found it impossible to use them all.

Perhaps it may be objected that in vol. i. I have introduced a number of pictures which have no direct bearing upon the text. This applies especially to the groups of natives, which, strictly speaking, are out of place there, for this work deals exclusively with the country, and not with the people. Nevertheless, I have not hesitated to print them, and for two reasons—in the first place, it will do no harm; and in the second place, it is precisely because the natives do not figure in the text that I have thought they might have a place in the illustrations. In vol. ii. I intend, unless the expense prove too heavy, to include a number of drawings I have made, illustrating racial types from Central and Western Asia.

The small sketch-maps in the text have been for the most part redrawn by Lieut. O. Kjellström in a very meritorious manner, and with praiseworthy industry. These small sketch-maps, as also the large maps in the atlas and all the autotypes, have been executed by the Lithographic Institute of the General Staff of the Swedish Army, the chief of which, Mr. A. Lagrelius, who is also my publisher, has rendered me the most disinterested and valuable assistance, both in

counsel and in deed, even with regard to the minutest details, for which I beg to thank him sincerely. The book is being printed by Messrs. P. A. Norstedt & Sons, under the superintendence of Mr. Carl Ramström, who has devoted to it his best attention. In the production of this book, I have laid it down as a fixed rule, that all the work connected with it should be executed in Sweden, so that foreign countries may have an opportunity of seeing what we are able to accomplish in this line here in Stockholm. At the suggestion of Prof. Supan and Dr. H. Wichmann, I add, as an appendix to this paper, one of the maps we are now publishing, the only difference being that in the atlas it is printed on thicker and more expensive paper. The sheet in question, Plate 10 in the atlas, has been composed and drawn by Major Byström from my original drawing, which was on a scale three times as big. The topographical features—that is to say, the sand-dunes—are drawn by Lieut. O. Kjellström. The most interesting sheet of the now published part of my atlas is, however, Plate 12. The explanatory text to this one sheet alone occupies eighty pages of vol. i., and is illustrated by four special maps of the lakes sounded, and three general maps throwing light upon the genesis of the region. I may perhaps be permitted, in a few words, to indicate the physico-geographical phenomena which have given rise to unusual and regular structure of this region, which is one of the most curious and interesting on the whole Earth. As the main stem and backbone, or rather as the principal artery, of this map we may with justice regard the Tarim, which is here flowing towards the south-east. On its left bank we have my headquarters at Yanghi-Kul, where my caravan spent the winter from December 7, 1899, to May 19, 1900. It was from this point I started on my two great excursions—one through the desert of Cherchen (the first two days of travel are shown on Plate 12), and the other through the desert of Lop; as well as the two shorter excursions I made to the lakes of Bash-Kul, Yanghi-Kul, and Gulme-Keti. Moreover, the map shows the first three-days' drift of the ferry-boat down the river in May and June, 1900, as also the routes of two canoe-trips undertaken from two fixed camping-places to the Karaunelik-Kul and the Ullugh-Kul.

By far the most conspicuous features on Plate 12, are the numerous elongated, and in part parallel, lakes lying close to one another on the right bank of the Tarim, and all of them fed by small canals from the river. According to the information I collected, these lakes number no less than thirty-five; but out of these I did not investigate more than six, a quite sufficient number, however, seeing that they are so like one another. Their dimensions, which are not very great, are shown in the following table :—

Name.	Length in km.	Max. breadth in m.	Min. breadth in m.	Mean breadth in m.	Area in square m.	Max. depth in m.	Mean depth in m.	Volume in cubic m.
Bash-Kul	15·9	2000	1000	1345	21,000,000	—	—	—
Yanghi-Kuti ...	13·35	1508	965	1244	15,000,000	—	—	—
Gulme-Kuti ...	8·0	2500	1000	1662	13,794,000	7·0	—	—
Karaunelik-Kul	5·2	2000	3000	1125	5,850,000	9·4	5·61	32,800,000
Ullugh-Kul ...	7·35	3200	—	—	14,860,000	10·0	4·92	69,500,000
Beghelik-Kul ...	11·6	4150	—	—	30,000,000	11·0	3·67	110,000,000

I have endeavoured to prove that the origination of these lakes is one of the causes of the shrinking of the Kara-koshun, a process which has been constantly going on during the twenty-five years that elapsed between Prjevalsky's first visit and my last visit.

Another circumstance, quite as peculiar and unexpected as the regular configuration of the lakes, is the fact that they are very considerably deeper than the parts of the river adjacent, so that on the right bank of the Tarim there is a whole series of depressions stretching from north-north-east to south-south-west, the lakes thus lying at right angles to the river. The entire system resembles a branch with its leaves attached, each lake-leaf hanging on to the stem by a short stalk. From the table above, it will be seen that the maximum depth of the four lakes sounded increases downstream, that is from west to east, but that the mean depth grows less, and is smallest in the most easterly of the lakes measured, namely the Beghelik-Kul, which is situated outside of the edge of Plate 12. But this must be a pure accident due to the insufficient number of soundings taken. In the Beghelik-Kul I took soundings at eighty-eight points, or three points in every square kilometre. But the feature which stands out with the sharpest distinctness in this series of soundings is the extraordinary regularity in the relief of the lake-bottom, and for our present purpose that is the principal thing. For instance, we ascertained that the greatest depths in all the lakes occur near their eastern shore, and the contours gradually rise towards the west. The very first glance I took at these lakes led me to suspect that the relief of their several basins must be of this character. For the eastern shore of each lake is overhung by the steep (33°) leeward slope of a dune-accumulation—that is, a heaping up of individual dunes into a compound mass—but on the west or windward side the surface slopes slowly up to the crest of the next dune-accumulation, while over on the western side of it there is yet another lake.

With the levelling-mirror I measured the height of the dune-accumulation which separates the Karaunelik-Kul from the Toghraklik-Kulning-dashi (the last named, being cut off from the river, contained salt water), and found that its culminating point was 89·5 metres (294 feet) above the surface of the Karaunelik-Kul. Other

measurements convinced me that the highest crests have in general an altitude of about 90 metres (300 feet), and this may be regarded as the limit beyond which the dunes in this region do not rise. It is at this altitude that the tendency of the dunes to increase in height is counterbalanced by the wind's transporting power.

My journey across the desert of Cherchen, a journey of 177 miles in length, proved to me that these gigantic ridges of sand stretch diagonally across almost the entire desert all the way to the Cherchen-daria; and at the Ettek-tarim I found that they begin on the very bank of the stream, or on the extreme eastern boundary of the desert. It is, however, in the northern part of the desert that the dune-accumulations or sand-ridges are most powerfully developed. In the desert of Cherchen the sand is arranged in waves, presenting the same appearance as the waves of an ocean across which a hard and steady wind is blowing.

At first it struck me as strange that these sand-ridges in the extreme north of the desert should run towards the south-west, and then gradually incline towards the south-south-west and south, until upon reaching the Cherchen-daria they stretch towards the south-south-east, thus describing arcs of circles. But I believe I have discovered the cause why the sand-ridges assume these directions. The greatest difficulty was to understand how it is possible for the storms of inconceivable violence (60 miles an hour at the surface of the Earth) which sweep, especially in spring, across the country of Lop and the adjacent regions, can arrange the sand-accumulations in such a way that the direction of the wind and the crest of the dunes form an acute angle with one another, because the natural expectation is that the wind must of necessity strike the crests of the dunes at right angles. It is only in the extreme south of the desert, where the dune-accumulations stretch towards the south-south-east, that this necessary physical law appears to be fulfilled. There must, of course, be a special reason for the apparent anomaly in the northern part of the desert. Upon noticing carefully the orientation of the individual dunes, I found that their crests do lie as I expected them to do, namely, at right angles to the wind. The explanation I have to offer of the anomaly to which I have called attention is this: assuming that the strength and direction of the wind are the same throughout the whole of the desert, then the deviation of the sand-ridges from the normal—that is to say, their curved shape—is due to the fact that the mass of sand in the northern dune-accumulations is greater than the mass of sand in the dune-accumulations in the south of the desert, so that the dunes in the south travel faster than those in the north. The consequence is, that the winds in the northern part of the desert strike the long axis of the dune-accumulations at an acute angle. Of course the curves which these sand-ridges describe are not perfectly regular, but,

as a rule, the angle may be said to increase from north to south; for instance, in *bajir* No. 1 it is 28°, and in *bajir* No. 4 87°, or as near as possible a right angle.

In between these stupendous waves of sand, built up by the remarkably constant east-north-east winds, which bring their materials from the disintegrated and crumbling Kuruk-tagh, there exist hollows or kumatic valleys, *i.e.* chains of depressions, parted from one another by comparatively low thresholds of sand. Each such depression—some of them are shown on Plate 12—is called by the natives a *bajir*, and forms a small self-contained basin, with a clay bottom, and is surrounded by sand, steep on the east side, and with a slow ascent to the next crest on the west. The lakes on the right bank of the Tarim are nothing but *bajir* depressions of this character, which by pure chance have become filled with water. The chance in question is that in former times the Tarim flowed due east along the bed of the Kuruk-daria, and emptied itself into the ancient lake of Lop-nor, but subsequently changed its direction to the south-east, washing away incalculable masses of sand from the desert. And the river is still at the present day continuing its destructive work—that is to say, it is travelling farther and farther towards the right, towards the south-west, breaking down and transporting the projecting ends of the sand-ridges, pushing itself farther and farther into the desert, levelling it down as it advances. An excursion by boat along this part of the river is extremely interesting, and offers a succession of grand and picturesque views. Time after time the river-loops penetrate southwards deeply into the high sand; dune-masses, 300 feet high, shoot straight down into the water at an angle of 33° from the right bank. The question arises, How is it possible that the dunes can be so steep just there, where they turn their broken ends to meet the predominant winds, for one would naturally expect those slopes to be extremely flat? The explanation is simply this—that the river keeps moving incessantly towards the south-west. On the one hand, the wind labours to make the upper layers of the dune-masses flatter and flatter, while on the other hand, the river keeps breaking down the base of the dunes and washing the sand away, thus preserving their steepness; and as the river is the stronger its effects prove the more permanent.

The lakes, however, offer no hindrance whatever to the advance of the dunes. The table above shows that their capacities are insignificant as compared with the volumes of the dune-accumulations. In spite of the lakes, the masses of sand continue their slow advance towards the west.

One of the clearest proofs that the dune-accumulations do travel is afforded by the characteristic shape of the lake-basins. The same shape occurs again in each and every one of the numerous bajir depressions of the desert—that is to say, they are always deepest at the base of the

steep leeward face of the dune-masses which rise on the east side of the depressions. It is this part of the basin which has for the longest time been exposed to the effects of corrasion and deflation—that is to say, to the excavating activity of the wind. The western side of the bajir is less deeply excavated, because it is relatively quite recently that the lowest part of the windward side of the westward dune-accumulation was swept off it. The bajir depressions themselves thus travel westwards along with the dune-accumulations. Whilst the dune-accumulations themselves maintain their individuality, altering their form but very slightly and very slowly, the bases upon which they stand are successively renewed after the lapse of countless centuries. But by the time they reach the Keriya-daria and the route I followed across the desert from the extreme northern tentacle of that river to the Tarim in February, 1896, they have entirely disappeared. The cause of their disappearance is, of course, the less degree of regularity and constancy shown by the winds in the western parts of the desert as compared with those in the country of Lop. In the desert of Takla-makan I did not observe a single trace of the almost unparalleled regularity that characterizes the desert of Cherchen.

A great part of vol. i. of 'Scientific Results' is occupied with the problems which I have here briefly indicated, and I have endeavoured to support my views with numerous diagrams and photographs. Possibly some of my views may appear rather bold, but such as they are I leave them to my critics to deal with. Several of the problems discussed in this connection can only be definitely explained and illustrated in vol. ii., after I have described the relief of the desert of Lop. This desert is grooved by countless gullies, 1 to 3 metres deep, and separated from one another by long clay ridges called *yardangs*, extending in a direction parallel to that of the prevailing wind, which blows here from the north-east, though in the northern part of the desert it comes even from the north-north-east. In this part of Asia it is the wind which, with dictatorial power, controls the surface of the Earth and determines its configuration; not only does it heap up the drift-sand in a manner which for regularity is unparalleled in any other part of the world, and wear down the clay desert by corrasion, but it also causes the river to change its course, and the lakes to migrate; when the lake of Lop-nor became filled with drift-sand and fluviatile sediment, the river shifted so as to flow into the basin of the Kara-koshun. Whilst this southern basin, which at the present time has a mean depth of barely 1 metre, is being filled up with solid material, the wind is continuing its excavating activity in the dry basin of the Lop-nor, and some day—I can predict it with almost mathematical certainty—the waters of the Kara-koshun will return there.

All I wished to say, however, is that vol. i. and vol. ii. are in every respect very intimately connected together, as indeed might

naturally be expected, seeing that they are both concerned with the Lowlands, or the vast basin of Central Asia.

At the present moment I am engaged upon vol. iii., which deals with Northern and Eastern Tibet, while in vol. iv. I shall describe Central and Western Tibet. The last route I have to describe is that from Leh to Kargalik *vid* the Karakorum pass. These two volumes will have two common indexes, one of names, the other of subject-matter, printed at the end of vol. iv. With regard to the treatment in the two volumes about Tibet, I will merely say here that my main object is to give a description, in diarial form, of the geography of the region I travelled through, the descriptive text thus running parallel to the sheets of the atlas, and describing their features in chronological order. This detailed description will, however, be followed by a general geographical survey of the relief of the Tibetan highlands, their orographical system and absolute altitudes, their self-contained basins and lakes. I hope, from the material I have collected, to be able to give a tolerably faithful picture of the morphology of Tibet. Vol. iii. and vol. iv. will be very profusely illustrated, and will afford a good opportunity of studying Tibetan mountain scenery in lithographic pictures of exceptional beauty.

Finally, summing up what I have already said above, I ask for indulgence for the great defects which unavoidably attach to my work. Had I been able to take with me a large staff of scientific associates, as my friend and countryman Otto Nordenskjöld did, the results would have been more copious; but somehow I like to work alone, and I always have worked alone. Certain parts of my journeys, such as the excursions across the deserts and my advance towards Lhasa (Lassa), were not unattended by a certain amount of peril, and I should hardly have been justified in venturing upon such forced marches had I had the lives of colleagues to answer for. The escort of Cossacks which the Russian Emperor placed at my disposal were ready to lay down their lives for me, a degree of self-sacrifice which is seldom found in those whom in everyday language we call associates and comrades.

Mommsen has somewhere said, speaking of himself, that he was only a child playing with stones on the shore of the ocean of knowledge. What shall I call myself, then? A child who has not even yet seen the immeasurably distant horizon of that same ocean, nor done more than glance at its immense expanse. But the experiences and observations which I have made in the course of my toilsome marches towards that wondrous shore, I herewith offer to the students of geographical exploration, in the hope that my labours have not been altogether in vain.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

Part VI.—The Lochs of the Ewe Basin.†

In this paper it is proposed to deal with the lochs visited by the Lake Survey draining into Loch Ewe, viz. Loch Maree, Lochan Fada, Lochs Garbhaig, Coulin, Clair, Tollie, Kernsary, Ghiuragarstidh, Mhic' Ille Riabhaich, a' Bhaid-Luachraich, Sguod, an t-Slagain, and an Drainc. The two last-mentioned lochs fall into the sea just outside the entrance to Loch Ewe, but it has been found convenient to include them with the lochs of the Ewe basin. The relations between the various lochs will be readily grasped by reference to the small index map of the district shown in Fig. 1. The drainage area under consideration extends from the mouth of Loch Ewe to the summit of Carn Odhar in the south, and close to the shores of Loch Fannich in the east, and is about 30 miles in length from north to south, and about 17 miles in maximum width from east to west. The total area is about 220 square miles (excluding Loch Ewe), and, as will be seen from the table at the end of this paper, about 185½ square miles drain into the lochs now to be dealt with, leaving about 35 square miles draining into the sea irrespective of these lochs. The head-waters of the basin on the south take their rise on the flanks of Beinn Liath Mhor and Carn Breac, flowing by the river Coulin into Loch Coulin, thence into Loch Clair, thence by the Allt Ghairbhe into the Kinlochewe river, at Kinlochewe, which falls into Loch Maree at its head. A short distance along the north-eastern shore Loch Maree receives the outflow from Lochan Fada by the Abhuinn an Fhasaigh, and, still further down, the outflow from Loch Garbhaig‡ by the Amhainn na Fuirneis. At its foot Loch Maree receives the outflow from Loch Tollie on the west, and from Lochs Ghiuragarstidh and Kernsary on the north-east, and its waters are carried by the river Ewe into the head of Loch Ewe. The outflow from Loch Sguod falls into Loch Ewe on its western shore, and the outflow from Lochs Mhic' Ille Riabhaich and a' Bhaid-Luachraich on its eastern shore. Loch an t-Slagain flows into Slaggan bay at the entrance to Loch Ewe, and Loch an Drainc flows into The Minch a short distance to the west of the entrance to Loch Ewe. A number of small lochs within the district now being dealt with could not be surveyed for lack of boats.

The geology of this district is described by Drs. Peach and Horne,

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* Plates, p. 616.

† In the preparation of this paper the field-notes of Mr. T. R. H. Garrett, B.A., were chiefly made use of.

‡ The smaller Loch Garbhaig lying to the west of Loch Maree was not sounded.

their important contribution appended to this paper being illustrated by a special geological map.

Loch Maree (see Plates I. and II.).—The loch derives its name from Saint Maelrubha, who in 671 A.D. left Bangor, and after founding one church at Applecross, founded another on Isle Maree. It is the largest

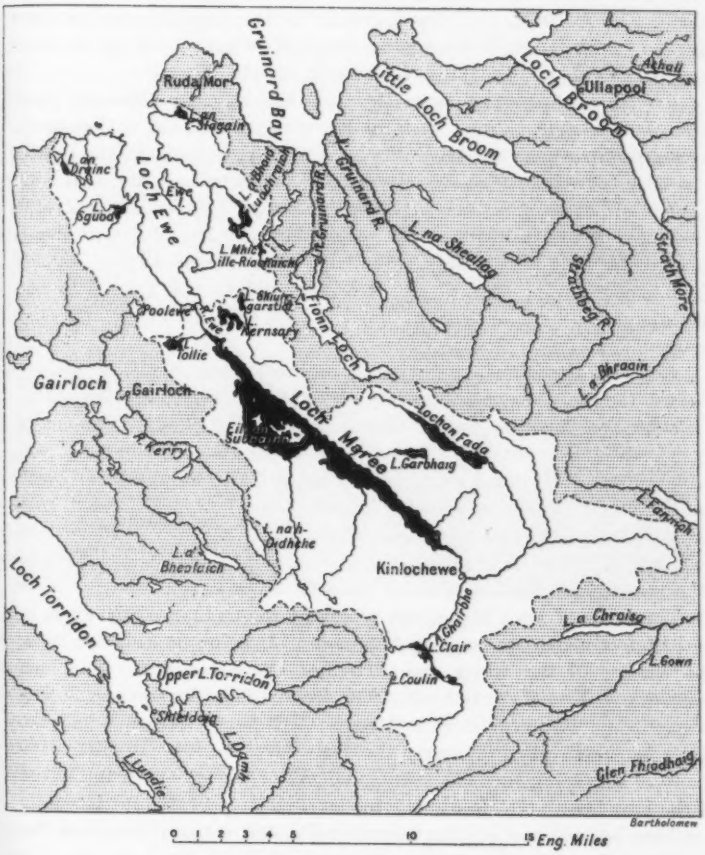

FIG. 1.—INDEX MAP OF THE MAREE DISTRICT.

sheet of fresh water in Scotland north of Loch Ness, and trends in a north-west and south-east direction.

On the north-east side of the loch, and parallel to it, runs a grand series of mountains—Beinn Airidh Charr, Meall Mheannidh, Beinn Lair, Slioch, Sgurr an Tuill Bhain and Beinn a Mhuinidh; the slope for the first 1000 feet all along this north-eastern shore is very steep, in many

places exceeding 45°. To the south-west rise Beinn Eighe, Beinn a Chearcaill and Beinn an Eoin; the sharp ridge of the former, composed of white quartzite, forms an especially fine object from the loch to the north of the Gruididh. But the two most striking features of Loch Maree are Slioch and Isle Maree; the huge sugar-loaf form of Slioch is conspicuous from almost every part of the loch, and, though one of the smaller islands, Isle Maree, owing to the large number of trees growing upon it, stands out against the dark background of the heather-covered islands and the cliffs of the north-eastern shore.

The great feature of Loch Maree is the large number and great area of its islands. Prof. Penck, in his work on the Lake of Constance, lays great stress on the "insulosity," *i.e.* "the proportion of the area of the islands to that of the water surface;" this in Loch Maree is 0·09, or three times as great as that of the Lake of Cheim (0·03), and nine times as great as that of the Lake of Constance (0·01). Its insulosity is also greater than that of any other large lake in Great Britain, that of Loch Lomond being 0·08, though it is surpassed in this respect by one of the small lochs in the Assynt district (Loch Crò:ach, whose insulosity is 0·091).

Many of the islands were joined together when the Lake Survey visited the loch owing to the low level of the water. A few small rocks and reefs occur out in the channel to the north of the main group of islands and removed some considerable distance from the rest. Large numbers of the Lesser Black-Backed Gull (*Larus fuscus*) breed on the larger islands, and two pairs and young of the Greater Black-Backed Gull (*Larus marinus*) were observed on two of the smaller islets. Isle Maree, Eilean Ghruididh, Eilean Subhainn, and Eilean Ruairid Bheag have been used at one time as fortresses or habitations.

The level of Loch Maree was found by the Ordnance Surveyors to be 32·1 feet above sea-level on September 15, 1870; on July 16, 1902, the surface of the water was 29·5 feet above sea-level. The loch was surveyed on July 16 to 24, 1902, by Sir John Murray, Dr. Johnston, Messrs. Parsons, Garrett, Hewitt, and James Murray, and the water remained at very nearly the same level during the nine days spent in surveying it. The average height of the water for the whole of the year is about 1½ feet above the level on July 16, 1902; the water has been known to rise 9 feet higher and to fall 1 foot lower than the level on this date.

Before dealing with the statistics of Loch Maree, it is necessary to state that there has been included in the loch a large portion of the piece of water styled "River Ewe;" soundings were taken in the so-called river, and depths of over 30 feet were obtained in places down to beyond the commencement of the Pool Crofts. Just above the partly artificial dam depths of 37 and 35 feet were obtained, and these would seem to point to the fact that down to here the "river" is nothing

more than an arm of the loch, with a current flowing along it to the outfall. That this place is the beginning of the river was evidently the opinion in past time, for it was here that the old iron-workers built their dam to obtain water for working "A Cheardach Ruardh" (The Red Smiddy).

The length of the loch as thus defined is $13\frac{1}{2}$ miles, and the maximum breadth rather over 2 miles. The mean breadth is nine-tenths of a mile, being 7 per cent. of the length. Its waters cover an area of over 11 square miles, and the islands nearly 1 square mile. Loch Maree has a large shore development, *i.e.* the length of the

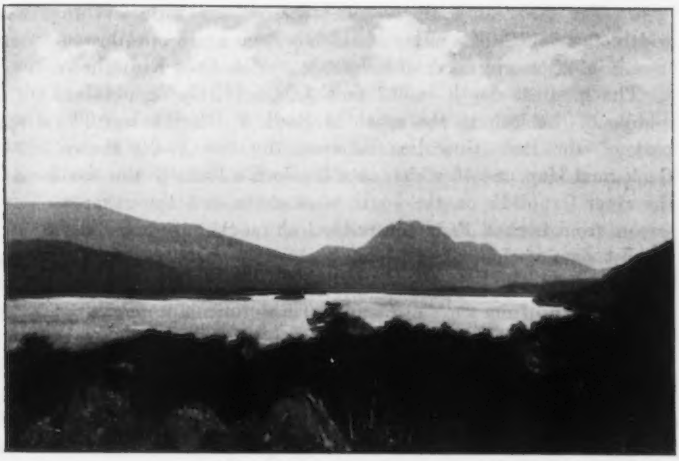

FIG. 2.—LOCH MAREE, THE ISLANDS IN THE MIDDLE DISTANCE.
(*Photo by J. A. Harvie-Brown, F.Z.S.*)

shore line is much greater than the circumference of a circle whose area is equal to that of the loch. The shore development is 3·15, being greater than that of any other large loch in Scotland. The drainage area is 171 square miles, or 15 times the area of the loch.

Twelve hundred soundings were taken in Loch Maree, and the greatest depth obtained was 367 feet, in the middle of the loch to the south-west of Rudh' a' Ghuibhais; the bottom of the loch here is thus $337\frac{1}{2}$ feet below sea-level. The volume of water is estimated at over 38,500 millions of cubic feet, and the mean depth at 125 feet (34 per cent. of the maximum depth). The breadth of the loch at the position of the deepest sounding is seven times the depth.

Loch Maree is divided into three main basins—(1) that extending from Isle Maree to the south-east end of the loch, which may be called the "Ghruididh basin;" (2) that lying to the south of the islands, which

may be called the "Slattadale basin;" and (3) that extending from the north-east of Eilean Ruairid Mòr to the north-west end of the loch, which may be called the "Ardlair basin."

(1) The Ghruididh basin. This basin is the largest and deepest of the three. The 200-feet area extends from a quarter of a mile to the east of Isle Maree to about half a mile from the south-east end of the loch, and has a length of $6\frac{1}{4}$ miles, its average width being about three-quarters of a mile. The main 300-feet basin has a length of 2 miles and a mean breadth of about a quarter of a mile; it extends from south of Coppachy to north of milestone 3 miles from Kinlochewe. There is another smaller 300-feet area a little to the north-west of the main area. The 350-feet basin has a length of one mile and an average width of one-sixth of a mile; it extends from north of milestone 5 miles from Kinlochewe to north of milestone 4 miles from Kinlochewe.

The greatest depth is 367 feet, this depth being obtained in the middle of the loch to the south of Rudh' a' Ghuibhais. The deepest part of the loch thus lies between the two faults shown on the Geological Map, one of which cuts the loch a little to the south-east of the river Gruididh on the south-west shore, and the other where the stream from Lochan Fada enters the loch on the north-east shore. The deepest part of this whole basin occurs where the great mass of Slioch on the one side, and the heights of the Kinlochewe Forest on the other, rise steeply up from the shore and, as it were, compress the valley into its narrowest limits.

This basin has a typical "cauldron shape," which is brought out in the section on the map, the slope on both sides down to the 350-feet contour-line being one of $26\frac{1}{2}°$; the flat portion in the middle is about 300 yards broad at the deepest place. The slope up to the 1000-feet contour-line is one of $24\frac{1}{2}°$ on the north-east shore, and one of 14° on the south-west shore.

It should be noted that the floor of the loch rises steeply where the second fault alluded to cuts it, that part of the loch lying to the south-east of this fault being very shallow. This feature is also seen where the same fault cuts the east end of Lochan Fada.

In Loch Maree a large number of the streams have formed very decided alluvial cones; *e.g.* the large one at the mouth of the Ghruididh river. This feature is much more marked in Loch Maree than in the majority of lochs. Other features of interest in this basin are the comparatively deep soundings in Ob nam Muc and the inlet to the south-east of this; and the curious hill on the bottom of the loch to the south of Letterewe (300 yards from the shore), the summit of which is covered by 44 feet of water.

(2) The Slattadale basin. This basin extends from west of Eilean Ruairid Mòr to south of Eilean Subhainn. The 150-feet area has a length of 2 miles and a mean breadth of a quarter of a mile. The curve

traced out by this contour to the east of the Slattadale river is very remarkable; the extension of the shallower part of the loch into the 150-feet area is in the direction of the Slattadale river, but the soundings nearer to the shore give no indication that this bank is due to the material brought down by the river. The 200-feet area extends from south of Eilean Ruairid Mòr to north of Stalla nam Manach, its length being nearly 1½ miles, and its average breath about 150 yards. The greatest depth is 232 feet in the extreme north-west of the basin. In a line with the curious indentation in the 150-feet contour-line the 200-feet basin is very narrow and shallow (202 feet).

Comparatively deep soundings were obtained in all the channels extending into the islands, and it is noteworthy that the long and narrow passage between Eilean Subhainn and Garbh Eilean lies in a line with the narrow prolongation of deeper water from Rudha Chailleach into the shallow water north of the islands.

Ob na h-Innse Moire in Eilean Subhainn was cut off from the main part of the loch by a sand-bar. This was also the case with the inlet to the north-west of Ob na h-Innse Moire, but this inlet had its surface covered with weeds and boulders.

(3) The Ardlair basin.—The outline of this basin is also very irregular, and the bottom more so than in either of the other basins. The 100-feet area has a length of 3½ miles and a mean breadth of three-quarters of a mile. The 200-feet area has a length of 2½ miles and an average breadth of one-third of a mile. The length of the 250-feet basin is two-thirds of a mile and the average breadth a quarter of a mile. The greatest depth in this basin is 285 feet, occurring about 700 yards to the south-east of Rudh' Aird an Anail.

In this basin the contour-lines run very close to the north-eastern shore in the western and central parts of the basin, but spread out towards the eastern part. Again, they run very close to the shore round the western coast of Eilean Ruairid Mòr and round Rudh' Aird an Anail. They have a very sinous outline in the eastern part of the basin.

As stated above, the floor of this basin is very irregular; several small hills rise above the general level of the bottom, as that to the south of Ardlair and that to the east of Rudh' Aird an Anail. The north-western extension of this basin, called "River Ewe," has already been noticed.

There remain for consideration the ridges between the basins and the large tract of shallow water to the north of the islands. The ridge which runs across from Eilean Ruairid Mòr to the mouth of Allt na Doire is very marked. The lowest part of the ridge is 83 feet below the surface of Loch Maree, whilst the distance between the two 100-feet contour-lines at this place is 120 yards, and that between the two 150-feet contours is 550 yards.

The shallow water to the north of the islands is much more remarkable. A large part of this area is under 50 feet in depth, and the deepest water that occurs anywhere between Creag Tharbh and Rudha Chailleach is 79 feet, though it is along this northern channel that the great fault must run. Right in the middle of the channel, underneath Creag Tarbh, the water is only 41 feet in depth; the hills on the north shore rise steeply up to heights of over 2000 feet in places, and the slope up to the 1000-feet contour-line is at an angle of 45°; hence the difference between the sub-aerial and the sub-aqueous slopes is in this place very marked. Rudha Chailleach (the witch's point) is a narrow spit of shingle stretching out to a considerable distance into the loch, with deep water close to the shore. From this point a narrow channel of deeper water projects right across the loch towards the opening between Eilean Subhainn and Garbh Eilean.

The ridge between the Slattadale and Ghruididh basins is merely a continuation of the islands. The depths on it are much less than on either of the other ridges; there is, however, a fairly deep channel, through which the steamer passes, ranging in depth from 62 feet to 28 feet; this channel is narrowest and shallowest between Isle Maree and Eilean Eachainn. To the south of Isle Maree is a large sand-flat, which in July, 1902, was covered by less than a foot of water, and on which were many boulders rising above the surface of the water.

The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	2090	29·6
50 „ 100	1283	18·2
100 „ 150	1066	15·1
150 „ 200	877	12·4
200 „ 250	977	13·9
250 „ 300	412	5·8
300 „ 350	254	3·6
Over 350	99	1·4
	7058	100·0

It will be observed that the zone between 200 and 250 feet is larger than that between 150 and 200 feet, otherwise the areas between the contour-lines drawn in at equal intervals decrease gradually with increase of depth.

The Small Loch on Eilean Subhainn.—Apparently this loch has not been considered important enough to receive a name, but the fact that it had the appearance of being of some depth, whereas the other lochs on the islands in Loch Maree are overgrown with weeds or moss, induced the Lake Survey to sound it. The trouble taken was well repaid by the curious nature of the bottom revealed by the soundings.*

* The method of sounding out this loch is interesting: it was found impossible to transport a boat to the loch, and Mr. Garrett took soundings by hand while swimming.

Eilean Subhainn is 292½ acres in area, its shore-line being very irregular. The surface of the ground is uneven, though nowhere except in the south-east corner is it very elevated; here, however, a small hill rises to a height of 84 feet above the level of Loch Maree. The greater part of the island is not more than 30 to 40 feet above Loch Maree, this rise for the most part taking place in the first 30 yards, and in some places there are vertical cliffs from 20 to 30 feet in height. In these cliffs it is seen that the island is composed of Torridon sandstone; the rock does not appear elsewhere except around the little loch, the island being covered with peat with a considerable number of fir-trees round the shore and in the south-east corner.

The loch lies in a small hollow in the centre of the island, being situated about a quarter of a mile from the south-east shore, and one-third of a mile from the west shore of the island, and about 150 yards from the Lily Loch. Its level was determined on July 24, 1902, to be 57·4 feet above sea-level, and 27·9 feet above the surface of Loch Maree.

The loch trends in an east and west direction, and its length is a little over 250 yards; its maximum breadth is about 100 yards, and the mean breadth about 70 yards. Its waters cover an area of nearly 5 acres, and its drainage area is ten times greater, or 51 acres; the shore development is 1·62 and the insulosity 0·02. The maximum depth is 64 feet, and hence the bottom of the loch is 30 feet below the level of Loch Maree, and 6½ feet below sea level. The volume of water contained in the loch is estimated at 6 millions of cubic feet, and the mean depth at 46½ feet.

The loch is fairly regular in outline, and has three small islands in it. The deepest part is a mere hole near the western end; on the ridge running across from the island near the north shore to the island with the tree there is only 5 feet of water, but there is a considerable depth of mud. In the eastern part of the loch depths of 12 feet were met with. Eighty-five per cent. of the total area of the loch is less than 50 feet in depth. This loch is the only one situated on an island in another loch, which has been visited by the Lake Survey. It was surveyed on July 24, 1902, by Messrs. Parsons and Garrett.

Temperature Observations.—Many surface temperatures were taken in Loch Maree between July 16 and 24, 1902, the greatest range observed being from 53°·3 off Letterewe at 11 a.m. on the 21st, to 57°·0 at Talladale at 7 p.m. on the 22nd. The surface temperature in the south-east end of the loch was almost always higher than that in the north-west end, owing to the north-west winds prevailing during the time the Lake Survey was on the loch. For instance, on July 19 the temperature of the surface north-west of Rudh' Aird an Anail was 53°·9 at 3 p.m., and off Ardlair it was 54°·0 at 4 p.m., whilst at 3.15 p.m. it was 55°·3 to the south-east of Fhasaigh.

Five serial observations were taken on July 19 and 21, as given in the following table :—

Depth in feet.	Loch Maree, opposite Pool Crofts, July 19, 1902, 12 noon. No wind; air-temperature, 54°·0.	Loch Maree, S.W. of E. Ruairid Mòr, July 19, 1902, 6 p.m. Stiff N. breeze; air-temperature, 53°·7.	Loch Maree, opposite Letterewe, July 21, 1902, 12.45 p.m. Air-temperature, 51°·6.	Loch Maree, N. of E. Ruairid Mòr, July 21, 1902, 1 p.m. Light N.W. breeze; air-temperature, 53°·5.		Loch Maree, off Rudh' a' Ghiubhais, July 21, 1902, 6 p.m. Moderate N.W. wind; air-temperature, 54°·0.
	°	°	°	°	°	°
0	53·5	54·7	53·9	53·9	53·9	54·5
5	—	—	53·8	—	—	54·2
7	—	—	—	—	—	—
10	—	—	53·6	53·7	53·7	54·2
15	53·6	54·7	53·5	53·3	53·4	—
20	—	—	53·5	—	—	54·2
25	—	54·0	—	53·5	53·7	—
30	53·6	—	53·3	—		54·0
35	—	—	—	53·2		—
50	—	53·0	53·1	53·0		54·0
75	—	50·0	50·8	50·3		53·6
80	—	—	—	—		—
85	—	—	—	—		49·6
100	—	48·0	49·0	48·2		48·0
150	—	48·1	46·9	46·6		46·4
200	—	47·0	45·9	46·0		45·9
250	—	—	45·4	—		—
300	—	—	—	—		45·6
350	—	—	—	—		45·5

Below the surface the fall in temperature was slow down to about 50 feet, when the fall became very rapid down to 150 feet, and then slow again to the bottom. Though these are the characteristics of the three series taken on the 21st, that taken on the 19th to the south of Eilean Ruairid Mòr in the Slattadale basin does not agree with the others. In this case there was a rapid fall from 20 to 100 feet, and then a slight rise in temperature to 150 feet, and then a slow fall again to 200 feet.

The series taken to the north of Eilean Ruairid Mòr on the 21st is interesting on account of the decided inversion at 25 feet. Though these inversions of temperature have occasionally been observed, they are by no means common. In this case it was noticed that the temperature fell from 53°·9 at the surface to 53°·7 at 10 feet, and to 53°·3 at 15 feet, and then rose to 53°·5 at 25 feet, and then fell again steadily below this depth. The series down to 25 feet was repeated with the results shown in the second column under this head, which proved that the inversion, though small, was real and not due to the instrument.

Lochan Fada (see Plate III.).—Lochan Fada (*i.e* the long loch) is the largest of its name. It is situated about 3 miles to the north-east of the upper end of Loch Maree, and runs parallel to it for a distance of 4 miles. The scenery around Lochan Fada is of the most magnificent description, Slioch and Beinn Lair overlooking it on the south-west

shore, and Beinn Tharsuinn and A Mhaighdean on the north-east shore. The ridge between Lochan Fada and Gorm Loch Mòr is particularly noticeable; the rise from the loch is 750 feet in 350 yards, and the top of the ridge is exactly like a knife-edge. The crags on the south-west shore are very bold and wild, being composed of the Beinn Lair sill of hornblende-schist, and extend from between Lochan Fada and Loch Garbhaig to south of Loch Fionn. When standing above the north-west end of the loch, the outlet to the south is not suspected; the loch appears to drain away down the continuation of the glen into Glen Na Muic. Doubtless at one time this was the outlet of the loch, for the col

FIG. 3.—LOCHAN FADA, LOOKING NORTH, SHOWING RIDGE.
(*Photo by T. N. Johnston, M.B., C.M.*)

here between Lochan Sgeireach and Loch Gleann na Muic is only 13 feet above the level of Lochan Fada. But Abhuinn an Fhasaigh, having a much shorter course than Abhuinn Gleann na Muic, has been able to cut back much more rapidly, and perhaps all the more so since its course lies along the line of fault, which runs from Loch Meallan an Fhudair to Loch Maree, and has tapped Lochan Fada, slightly lowering its level, thus beheading Abhuinn Gleann na Muic.

The height of the loch above sea-level was not determined by the Ordnance Survey, nor by the Lake Survey, owing to absence of bench-marks, but, judging from the spot-levels, and the 1000-feet contour-line, its level must be about 1005 or 1006 feet above the sea.

The length of Lochan Fada is $3\frac{3}{4}$ miles, and its maximum breadth

nearly two-thirds of a mile; the mean breadth is over one-third of a mile. Its waters cover an area of nearly $1\frac{1}{2}$ square miles, and it drains an area $6\frac{1}{2}$ times greater, or over $9\frac{1}{3}$ square miles. The maximum depth is 248 feet; this occurs in the centre of the loch off the mouth of Allt Meallan a' Chruidh. The mean depth is estimated at 102 feet, and the volume at 4091 millions of cubic feet. The breadth of the loch at the position of the deepest sounding is twelve times the depth. The shore development is 2·16, and the insulosity is *nil;* Lochan Fada, like so many of the larger lochs, has not a single island.

The bottom of Lochan Fada is very regular, the 50-feet and 100-feet areas being continuous, and extending almost from one end of the loch to the other. The main 150-feet area extends from west of Claona to the narrower part of the loch, and has a length of $1\frac{1}{2}$ miles; there is a small 150-feet area near the south-east end of the loch. The 200-feet area extends from south-west of Claona to west of Allt na Botaig; its length is one mile, and average width 280 yards.

The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 50	230 ...	25·0
50 „ 100	236 ...	25·7
100 „ 150	263 ...	28·7
150 „ 200	100 ...	10·8
over 200	90 ...	9·8
	919	100·0

It is unusual to observe, on proceeding from the shore into deeper water, an increasing area between the contour-lines drawn at regular intervals, as in the case of Lochan Fada, and indicates an average steep slope near shore. A glance at the map shows that the 50-feet contour follows closely the outline of the loch, and in places approaches very close to the shore.

Seiche.—On July 28, beginning at 1 p.m., a well-marked seiche was observed in Lochan Fada in a sheltered bay at the south-west end of the loch; the wind was strong from the west. The amplitude was half an inch, and the period about 11·6 minutes; but this oscillation was so broken up by two other oscillations, whose periods were about $2\frac{1}{2}$ minutes and 1 minute respectively, that the whole effect was extremely complicated, and no calculations could be made from the observations.

The loch was surveyed on July 25 to 28, 1902, by Messrs. R. M. Clark, B.Sc., and James Murray.

Temperature Observations.—The temperatures taken in Lochan Fada are extremely interesting, because they indicate a much lower temperature than was observed in any of the other lochs in the district at the same time of the year, as shown by the following series taken at 6.40 p.m., on July 28, 1902, to the south of Allt Meallan a' Chruidh:—

Surface	... ...	51°·1 Fahr.
10 feet	... ...	51°·1 „
20 „	... ...	51°·1 „
50 „	... ...	51°·0 „
75 „	... ...	45°·8 „
100 „	... ...	45°·0 „
150 „	... ...	44°·3 „
220 „	... ...	44°·1 „

This series indicates an almost constant temperature down to 50 feet, then a fall of 5°·2 between 50 and 75 feet (a fall exceeding 1°·0 per 5 feet of depth), and then a slight decrease of 1°·7 down to the bottom in 220 feet. Compared with the larger and deeper Loch Maree, the water in Lochan Fada was found to be colder at all depths than that in Loch Maree: thus the surface of Lochan Fada had a temperature about 3½° lower than was observed in the surface waters of Loch Maree a week earlier, and at the bottom of Lochan Fada, in 220 feet, the temperature was found to be about 1½° lower than at the bottom of Loch Maree in 350 feet. This is probably due to the fact that Lochan Fada is very deep, considering its area, and therefore a large volume of water has to be warmed, while only a comparatively limited area is exposed to the heating agencies.

Loch Garbhaig (see Plate I.).—Loch Garbhaig lies between Lochan Fada and Loch Maree, about half a mile from the former and 1½ miles from the latter. It drains into Loch Maree by the Amhainn na Fuirneis, which leaves the loch at its western end, and, flowing in a westerly direction, enters Loch Maree between Furness and Letterewe. The ground at the eastern end is not much elevated above the surface of the loch, the col leading over to Lochan Fada, but on the south side Slioch rises up from the shore to a height of 3200 feet, and on the north side the high ground to the east of Beinn Lair rises to over 2500 feet. The most noticeable feature of the surrounding country is its bareness. The height of the loch above the sea was not determined by levelling when surveyed by Dr. Johnston and Mr. Hewitt on July 25, 1902, but from the contour-lines the level is probably between 1005 and 1015 feet.

Loch Garbhaig is over a mile in length, with a maximum breadth of nearly one-third of a mile, the mean breadth being one-fifth of a mile. Its waters cover an area of about 148 acres, and it drains an area 10½ times greater, or nearly 2⅓ square miles. The maximum depth of 93 feet was observed about 300 yards from the eastern shore. The volume of water contained in the loch is estimated at 228 millions of cubic feet, and the mean depth at 35½ feet. The breadth of the loch at the position of the deepest sounding is sixteen times the depth. The shore development is 2·15 and the insulosity 0·014.

The 25-feet area is continuous, passing to the north of the large

island. The 50- and 75-feet areas lie in the eastern part of the loch, though there is one sounding of 50 feet in the extreme west. The 50-feet area has a length of nearly half a mile, and extends to within 40 yards of the eastern shore, while the 75-feet area is a quarter of a mile in length. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	67 ...	45·4
25 „ 50	42 ...	28·3
50 „ 75	20 ...	13·8
over 75	19 ...	12·5
	148	100·0

The temperature of the surface water in Loch Garbhaig at 4 p.m. on July 25, 1902, was 54°·9 Fahr., or nearly 4° warmer than that observed in Lochan Fada, which lies at the same elevation; no serial temperatures were taken.

Loch Clair (see Plate IV.).—Loch Clair is situated about 3 miles to the south-west of Kinlochewe, at the head of Loch Maree. The ground to the north and west rises to the heights of Beinn Eighe and Sgurr Dubh, the lower ground being covered by moraines. It was surveyed on July 24, 1902, by Messrs. Clark and Murray, and the elevation of the water-surface above the sea was determined by levelling from bench-mark as being 303·1 feet.

Loch Clair is over $1\frac{1}{3}$ miles in length, with a maximum breadth of about 600 yards, the mean breadth being about 300 yards. Its waters cover an area of about 160 acres (a quarter of a square mile), and it drains directly an area of $6\frac{1}{3}$ square miles, but since it receives the outflow from Loch Coulin its total drainage area is $20\frac{1}{3}$ square miles —an area 83 times greater than that of the loch. The maximum depth is identical with that observed in Loch Garbhaig, viz. 93 feet, and occurs about 150 yards from the eastern shore off Creag na Rianaich. The volume is estimated at 287 millions of cubic feet, and the mean depth at 42 feet. The breadth of the loch at the position of the deepest sounding is sixteen times the depth. The shore development is 2·01, and the insulosity very small (0·001), there being only two small islands in the loch.

The bottom of Loch Clair is fairly regular, the deeper water being found in the wide south-eastern portion, where there is a 50-feet basin about half a mile in length, enclosing a 75-feet basin one-third of a mile in length. The 25-feet area is continuous, passing to the south of the larger island, between which and the southern shore a depth of 46 feet was found. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows :—

Feet.				Acres.		Per cent.
0 to 25	...	...	...	58	...	34·9
25 „ 50	...	...	...	38	...	24·4
50 „ 75	...	...	...	41	...	25·9
over 75	...	...	...	23	...	14·8
				160		100·0

It will be observed that the zone between 25 and 50 feet is smaller than the zone between 50 and 75 feet, indicating that the average slope is steeper in the shallower zone.

FIG. 4.—LOCH COULIN, LOOKING NORTH.
(*Photo by T. N. Johnston, M.B., C.M.*)

Temperature Observations.—A series of temperatures taken at 4 p.m. on July 24, 1902, in the deep water gave the following results:—

Surface	...	...	...	...	...	57°·0 Fahr.
5 feet	...	...	...	...	...	57·7 „
10 „	...	...	...	...	...	57·2 „
20 „	...	...	...	...	...	57·2 „
30 „	...	...	...	...	...	54·0 „
40 „	...	...	...	...	...	49·9 „
50 „	...	...	...	...	...	48·7 „
85 „	...	...	...	...	...	48·0 „

It will be noticed that the temperature of the water between 5 and 20 feet was higher than that at the surface, the highest reading being at 5 feet. Between 20 and 30 feet a fall of 3°·2 is recorded, and

between 30 and 40 feet a fall of 4°·1, a total fall of 7°·3 in 20 feet, the extreme range shown by the observations being 9°·7.

Loch Coulin (see Plate IV.).—Loch Coulin is situated 300 yards to the south-east of Loch Clair, into which it drains. Doubtless, in very recent times, they formed one loch, for the ground between them is low and alluvial. To the south-west and south-east rise Beinn Liath Mòr and Carn Breac. Loch Coulin is very much overgrown with weeds, especially in the narrow north-western portion. It was surveyed on July 24, 1902, by Dr. Johnston and Mr. Hewitt, who found the water-surface to be 304·6 feet above sea-level, or 1½ feet above the level of Loch Clair.

Loch Coulin is 1⅓ miles in length, with a maximum breadth of one-third of a mile, the mean breadth being about 250 yards. Its waters cover an area of 113 acres, and it drains an area 78 times greater, or 14 square miles. The maximum depth of 49 feet occurs near the centre of the broader south-eastern portion of the loch. The volume of water is estimated at 90 million cubic feet, and the mean depth at 18¼ feet. The breadth of the loch at the position of the deepest sounding is 31 times the depth. The shore development is 2·45, and the insulosity *nil*.

Loch Coulin is very irregular in outline, and is cut up into three basins, the north-western basin having a maximum depth of 32 feet, and the central basin a maximum of 22 feet. The main basin is confined to the broad south-eastern part of the loch, and the contour-lines approach very close to the eastern shore, off which the slope is steep. There are two isolated soundings less than 25 feet within this area, and deep water is found at the entrance of the river Coulin. The area covered by less than 25 feet of water is over 80 acres, or 72 per cent. of the entire area of the loch.

Temperature Observations.—A series of temperatures was taken in the deep part of the loch at 5 p.m. on July 24, 1902, with the following results:—

Surface	57°·0 Fahr.
5 feet	57°·0 „
10 „	57°·1 „
15 „	57°·0 „
20 „	55°·5 „
30 „	54°·8 „
40 „	53°·0 „

The temperature was found to be constant from the surface to a depth of 15 feet, thence the temperature fell 4° to the bottom in 40 feet.

Loch Tollie (see Plate II.).—Loch Tollie is situated 1¼ miles to the west of the lower end of Loch Maree, and drains into its north-western arm. The ground immediately surrounding the loch is low, though

Meall Airidh Mhic Criadh to the south-west, and Creag Mhòr Thollie to the south-east, rise to over 1100 feet. The loch is roughly elliptical in outline, the major axis having an east and west direction. One of the islands near the northern shore was for some time a stronghold of the McLeods.

Loch Tollie was surveyed on July 29, 1902, by Dr. Johnston and Mr. Hewitt, who determined the elevation of the lake-surface as being 387·0 feet above sea-level; when visited by the Ordnance Survey officers on November 13, 1869, the level was found to be 387·7 feet. The water must at one time have stood at a higher level, for at the east end, where the stream leaves the loch, there are the remains of a dam (now fast disappearing), which held up the water for supplying a mill farther down the burn.

Loch Tollie is under a mile in length, with a maximum breadth of about 800 yards, the mean breadth being about 500 yards. Its waters cover an area of about 169 acres (a quarter of a square mile), and it drains an area eight times greater, or 2 square miles. The maximum depth of 86 feet was observed in the centre of the loch off the mouth of the Allt Loch Laraig. The volume of water is estimated at 244 millions of cubic feet, and the mean depth at 33 feet. The breadth of the loch at the position of the deepest sounding is 27 times the depth. The shore development is small (1·11), and the insulosity 0·002. The deeper water occurs in the western part of the loch, though the 25-feet area sends a narrow tongue into the eastern part. The 75-feet area in the centre of the loch is small, with a narrow tongue extending towards the northern shore. The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	81 ...	48·0
25 „ 50	43 ...	25·6
50 „ 75	35 ...	20·6
over 75	10 ...	5·8
	169	100·0

Temperature Observations.—The following series of temperatures was taken in the centre of the loch at 6 p.m. on July 29, 1902:—

Surface	55°·5 Fahr.
5 feet	55°·5 „
10 „	55°·3 „
20 „	55°·3 „
30 „	55°·2 „
50 „	55°·1 „
60 „	54°·3 „
70 „	50°·9 „

This series shows that the temperature was practically constant down to 50 feet, the fall being less than ½°, thence a fall of 0·8 between 50 and 60 feet, and then a rapid fall of 3°·4 between 60 and 70 feet.

Loch Kernsary (see Plate II.).—Loch Kernsary is situated to the north-east of Inveran, at the foot of Loch Maree, into which it drains through the little loch Poll Uidhe a' Chrò' and the Inveran river. There was no boat passage into Poll Uidhe a' Ghrò', and it was found impossible to carry the boat across. The ground around Loch Kernsary is low, except to the north, where Meall an Leathaid Dharaich rises to over 400 feet. The island near the south-western shore in the main portion of the loch is an artificial crannog, but nothing is known of its history.

Loch Kernsary was surveyed on July 25 and 26, 1902, by Messrs. Parsons and Garrett, who determined the elevation of the water-surface above the sea, by levelling from Loch Maree, as being 68 feet. The keeper stated that the water would rise $2\frac{1}{2}$ feet above, and fall 1 foot below this level, but a drift mark was observed 8·4 feet above the surface of the water.

Loch Kernsary is about $1\frac{1}{3}$ miles in length, with a maximum breadth of nearly half a mile, the mean breadth being about 350 yards. Its waters cover an area of about 200 acres, and it drains directly an area of nearly $7\frac{3}{4}$ square miles, but since it receives the outflow from Loch Ghiuragarstidh its total drainage area is over $8\frac{1}{2}$ square miles,—an area $27\frac{1}{2}$ times greater than that of the loch. The maximum depth of 93 feet was observed about 250 yards from the north-western extremity of the loch. The volume of water is estimated at 333 million cubic feet, and the mean depth at 38 feet. The breadth of the loch at the position of the deepest sounding is ten times the depth. The shore development is 2·51, and the insulosity 0·008.

The floor of Loch Kernsary is rather irregular, there being two 25-feet areas and four 50-feet areas. The main 25-feet area extends throughout the greater part of the loch, while the smaller one lies in the south-western part of the loch. Three of the 50-feet areas are enclosed by the main 25-feet area: the north-western one containing the deepest water in the loch, the central one having a maximum depth of 66 feet, and the south-eastern one a maximum depth of 69 feet, therefore falling just below sea-level; the fourth 50-feet area, based on soundings of 51 and 53 feet, lies in the centre of the south-western part of the loch. The 75-feet area is situated in the north-western part of the loch, and sinks below sea-level, the deepest spot being 25 feet below the level of the sea.

The areas between the consecutive contour-lines, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	72	35·8
25 „ 50	69	34·4
50 „ 75	39	19·8
over 75	20	10·0
	200	100·0

Thus 70 per cent. of the lake-floor is covered by less than 50 feet of water.

Temperature Observations.—A series of temperatures was taken in the deep part of the loch at 2.30 p.m., on July 25, 1902, with the following results :—

Surface	57° 0 Fahr.
10 feet	57°·0 „
25 „	56°·8 „
50 „	53°·0 „
80 „	50°·2 „

This series shows an almost constant temperature down to 25 feet, then a rapid fall of 3°·8 between 25 and 50 feet, and a further fall of 2°·8 between 50 and 80 feet.

Loch Ghiuragarstidh (see Plate II.).—Loch Ghiuragarstidh lies about half a mile to the north of Loch Kernsary, into which it drains by the Allt Loch Ghiuragarstidh. The islands are covered by a few feet of peat and soil, and have many fir-trees growing on them. The loch was surveyed on July 28, 1902, by Messrs. Parsons, Hewitt, and Garrett, who determined the elevation of the lake-surface, by levelling from Loch Kernsary, as being 116·7 feet above mean sea-level.

Loch Ghiuragarstidh is about 1200 yards in length, with a maximum breadth of about 370 yards, the mean breadth being about 230 yards. Its waters cover an area of 58 acres, and it drains an area nearly ten times greater, or about 560 acres. The volume of water is estimated at 23 million cubic feet, and the mean depth at 9 feet. The breadth of the loch at the position of the deepest sounding is 27 times the depth. The shore development is 1·63 and the insulosity 0·028. The bottom is very irregular in the southern half of the loch, large boulders and reefs rising above the surface of the water in many places. In the northern half the lake-floor is more regular, and it is only in this part that the depth exceeds 10 feet, the maximum depth of 37 feet having been observed in the centre of the loch near the northern end. The area of the lake-floor covered by less than 25 feet of water is about 56 acres or 96 per cent. of the total area.

Temperature Observations.—Temperatures taken at 5 p.m. on July 28, 1902, in the deep part of the loch gave the following results :—

Surface	57°·5 Fahr.
5 feet	57°·5 „
7 „	57°·5 „
15 „	57°·1 „
25 „	56°·0 „

Loch a' Bhaid-Luachraich (see Plate V.).—Loch a' Bhaid-Luachraich

(or Goose Loch) lies about a mile to the east of Loch Ewe, into which it drains at Aultbea by the Allt Bheithe. It is surrounded by low rounded hills, steep only towards the south-east, covered with peat or morainic material. It is extremely irregular in outline, and in fact may almost be looked upon as two lochs with a connecting arm. The south-western part is shallow, the maximum depth observed in it being 43 feet, while the north-eastern part is much deeper, having a maximum depth of 143 feet; the maximum depth observed in the connecting arm was 15 feet. The lower part where the stream leaves the loch is thickly overgrown with reeds and rushes, and weeds are abundant in the two bays at the head of the loch. It was surveyed on July 29 and 30, 1902, by Messrs. Parsons and Garrett, and the elevation was determined by levelling from bench-mark, as being 309·6 feet above the sea; when levelled by the officers of the Ordnance Survey on August 3, 1870, the elevation was found to be 310·5 feet above sea-level.

From the table at the end of this paper it will be seen that Loch a' Bhaid-Luachraich is over 1½ miles in length, and over a mile in maximum breadth, with a mean breadth of one-third of a mile. It covers an area of half a square mile, and it drains directly an area of 3¼ square miles, but since it receives the outflow from Loch Mhic' Ille Riabhaich its total drainage area is nearly 4 square miles,—an area eight times greater than that of the loch. The volume of water is estimated at 486 million cubic feet, and the mean depth at 34 feet. The bottom in the south-western part of the loch is rather irregular, while the north-eastern part forms a simple deep basin, the maximum depth of 143 feet having been observed near the centre at the widest part of this portion. Section A–B is taken across this wide portion at the position of the deepest sounding. The areas between the consecutive contour-lines, and the percentages to the total area, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	184 ...	56·2
25 „ 50	84 ...	25·5
50 „ 75	17 ...	5·3
75 „ 100	17 ...	5·0
over 100	26 ...	8·0
	328	100·0

These figures indicate that the average slope is gentle in the shallower water, and much steeper in depths exceeding 50 feet, but it will be observed from the map that the contour-lines approach very close to the shores in certain places, indicating a steep slope in these positions.

Temperature Observations.—The surface temperature at 11.45 a.m. on July 29, 1902, was 56°·1, and at 4 p.m. on July 30, when the following series was taken, it was more than half a degree lower :—

Surface	...	...	...	...	...	...	...	55°·4 Fahr.
10 feet	...	...	...	...	...	...	...	55°·4 „
20 „	...	...	...	...	...	...	...	55°·4 „
30 „	...	...	...	...	...	...	...	55°·4 „
50 „	...	...	...	...	...	...	...	53°·6 „
75 „	...	...	...	...	...	...	...	49°·8 „
85 „	...	...	...	...	...	...	...	48°·4 „
120 „	...	...	...	...	...	...	...	47°·2 „

This series shows a constant temperature from the surface down to 30 feet, then a slight fall of 1°·8 between 30 and 50 feet, followed by a rapid fall of 5°·2 between 50 and 85 feet, thence to the bottom a slight fall of 1°·2, the total range of temperature from surface to bottom being 8°·2.

Loch Mhic' Ille Riabhaich (see Plate V.).—Loch Mhic' Ille Riabhaich is a small irregular shallow loch lying to the south-east of Loch a' Bhaid-Luachraich, into which it flows by the Allt na Criche, surrounded by low rounded hills; on one of the islands is a fortress, but nothing seems to be known of its history. It was surveyed on July 31, 1902, by Mr. Parsons, but its elevation above the sea could not be determined; from the contour-lines on the Ordnance Survey maps it is apparently rather less than 600 feet above the sea. It is half a mile in length from north to south, and rather less in maximum breadth from south-east to north-west. It covers an area of about 36 acres, and drains an area of nearly three-quarters of a square mile. Two soundings of 12 feet were taken near the north end at the outflow, and a sounding of 10 feet off the eastern shore of the larger island; with these exceptions the lake-floor is covered by less than 10 feet of water. The volume is estimated at 8 million cubic feet, and the mean depth at $5\frac{1}{3}$ feet.

The temperature of the surface water at 12.30 p.m. on July 31, 1902, was 57°·0 Fahr., identical with the air temperature at the same time.

Loch nan Dailthean (or na Daline), lying to the south-west of Loch Mhic' Ille Riabhaich, and flowing into Loch Thuirnaig (an inlet of Loch Ewe), was visited by the Lake Survey, but not sounded. It is said to be so shallow that cows may walk over the whole of it, except a small hole near Thuirnaig House, in which the depth is 4 feet.

Loch an t-Slagain (see Plate V.).—Loch an t-Slagain lies to the east of Slaggan bay, at the entrance to Loch Ewe, into which it flows by the Allt an t-Slagain. It is surrounded by low hills, and receives the outflow from several small lochs lying to the east and south. It was surveyed on August 11, 1902, by Messrs. Parsons and Garrett, who determined the elevation above the sea by levelling to be 103·5 feet; when visited by the officers of the Ordnance Survey on May 5, 1875, its elevation was 102·6 feet above sea-level. The height of the highest drift mark observed was 2·3 feet above the surface of the water

on August 11, 1902, so that the range of level is probably between 3 and 4 feet. The loch trends in a north-west and south-east direction, and is two-thirds of a mile in length by one-third of a mile in maximum breadth. Its waters cover an area of about 77 acres, and it drains an area 17 times greater, or over 2 square miles. The maximum depth of 55 feet was observed comparatively very near the south-eastern shore. The volume of water is estimated at 55 million cubic feet, and the mean depth at 16½ feet.

Loch an t-Slagain is of simple conformation, the 10-feet area being continuous from end to end, but the deeper water is cut into two portions by the shallower water around the central islands. To the north-west of the islands two soundings of 25 feet were recorded, while the deepest part of the loch lies to the south-east of the islands. The areas between the consecutive contour-lines, and the percentages to the total area, are as follows :—

Feet.				Acres.		Per cent.
0 to 10	...	...	...	27	...	35·3
10 „ 25	...	...	...	39	...	50·6
25 „ 50	...	...	...	8	...	10·6
over 50	...	...	...	3	...	3·5
				77		100·0

Thus 86 per cent. of the lake-floor is covered by less than 25 feet of water, and the major portion is covered by water between 10 and 25 feet in depth.

Loch Sguod (see Plate V.).—Loch Sguod lies less than half a mile from the western shore of Loch Ewe (opposite the Isle of Ewe), into which it flows by the Uidh Chrò. It drains the higher ground to the west and south-west by several streams flowing through the low peat bogs which surround the loch on all sides. It was surveyed on August 15, 1902, by Messrs. Parsons and Garrett, but its elevation above the sea could not be determined; the water may rise 2 feet above its level on the date mentioned. Loch Sguod is nearly three-quarters of a mile in length, with a maximum breadth of nearly half a mile, the mean breadth being a quarter of a mile. Its waters cover an area of about 107 acres, and it drains an area 26 times greater, or 4½ square miles. The maximum depth of 14 feet was recorded towards the eastern shore. The volume of water is estimated at 32 million cubic feet, and the mean depth at 7 feet, or half the maximum depth. The loch is quite simple in conformation, but the deeper water is confined to the central and north-eastern parts of the loch, approaching very close to the eastern shore, off which the slope is steep. The area of the lake-floor covered by less than 10 feet of water is about 78 acres, or 73 per cent. of the total area. The temperature of the surface water at 9 a.m. on August 15, 1902, was 57°·2 Fahr.

Loch an Drainc (see Plate V.).—Loch an Drainc (or an Druing) lies to the north-west of Loch Sguod, and flows through Loch nan Eun (which was not sounded) and the Abhuinn Leumnach into The Minch, about 2½ miles to the west of the entrance to Loch Ewe. The ground around the loch is mostly covered with peat, and to the east are low but steep knolls 200 to 300 feet in height, dotted over with small and beautiful lochs, while to the west and south there is a fairly steep ascent to Maol Breac, An Cuaidh, and Bac an Lethchoin (over 900 feet), the sides of which are well-wooded. It was surveyed on August 16, 1902, by Messrs. Parsons and Garrett, but the elevation above the sea could not be determined; the water may rise 2 to 3 feet above its level on this date. Loch an Drainc trends north-north-west and south-south-east, and is nearly three-quarters of a mile in length, with a maximum breadth of over one-third of a mile, the mean breadth being nearly a quarter of a mile. Its waters cover an area of about 96 acres, and it drains an area 22 times greater, or nearly 3½ square miles. The maximum depth of 55 feet is approximately centrally placed, but nearer the western than the eastern shore. The volume of water is estimated at 108 million cubic feet, and the mean depth at 26 feet, or nearly half the maximum depth. The loch forms a simple basin, and, considering its area, is comparatively deep, the 25-feet area being over half a mile, and the 50-feet area one-fifth of a mile, in length. The areas between the consecutive contour-lines, and the percentages to the total area, are as follows :—

Feet.	Acres.	Per cent.
0 to 25	47 ...	48·9
25 „ 50	45 ...	47·2
over 50	4 ...	3·9
	96	100·0

Temperatures taken at 3 p.m. on August 16, 1902, gave 59°·0 at the surface, and 58°·0 at a depth of 40 feet.

The deposits from certain parts of Loch an Drainc, as well as of Loch Sguod, were of a strikingly pink colour, and a sample from a depth of 20 feet in Loch an Drainc was found to be coherent when dry, and when wet plastic and creamy, not unlike cocoa and milk of a pink brown colour. The material is made up of probably 90 per cent. of clayey matter with minute mineral particles less than 0·05 mm. in diameter, the remaining 10 per cent. consisting of mineral particles with a mean diameter of 0·15 mm. Quartz is the principal mineral species, but small grains of pink microcline-felspar are very abundant, and it is apparently to this mineral that the pink colour of the deposit is due; the microcline shows cross-hatching, and is much kaolinized. The washed mineral grains have a decided pink tinge, which is, however, much more pronounced in the fine washings. Besides quartz and felspar, white and brown mica, hornblende, garnet, and magnetite were observed. There is little or no vegetable matter.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Maree	29·5	1196	13·46	2·16	0·89	6·6	367	125·3	34·1	194	567	38,539	11·03	171·66	15·4
Loch on Eilean Subhainn	57·4	10	0·18	0·06	0·04	22·2	64	29·7	46·4	15	32	6	0·01	0·80	80·0
Lochan Fada	[1005]	227	3·74	0·62	0·38	10·2	248	102·2	42·2	80	193	4091	1·44	9·37	6·5
Garbhaig	[1010]	82	1·18	0·30	0·19	16·1	93	35·4	38·1	67	176	228	0·23	2·41	10·5
Clair	303·1	100	1·38	0·34	0·18	13·0	93	42·1	45·3	78	173	287	0·24	20·39	83·2
Coulin	304·6	120	1·33	0·34	0·14	10·5	49	18·3	37·3	143	384	90	0·18	14·07	78·1
Tollie	387·0	101	0·90	0·44	0·29	32·2	86	33·1	38·4	55	143	244	0·26	2·00	7·7
Kernsary	68·0	148	1·35	0·40	0·23	17·0	93	38·2	41·0	77	187	333	0·31	8·56	27·6
Ghiuragarstidh ...	116·7	68	0·68	0·21	0·13	19·1	37	9·1	24·5	97	396	23	0·09	0·87	9·7
Bhaid-Luachraich ...	309·6	217	1·57	1·10	0·33	20·8	143	34·0	23·8	58	244	486	0·51	3·91	7·7
Mhic' Ille Riabhaich ...	[less than 600]	34	0·49	0·46	0·11	22·4	12	5·3	44·6	216	483	8	0·06	0·67	11·2
An t-Slagain	103·5	64	0·65	0·30	0·18	27·7	55	16·4	29·9	62	209	55	0·12	2·04	17·0
Sguod	—	48	0·72	0·44	0·24	33·3	14	6·9	49·4	271	550	32	0·17	4·47	26·3
An Drainc	—	58	0·72	0·36	0·21	29·2	55	25·9	47·0	69	147	108	0·15	3·43	22·9
		2473										44,530	14·80	185·51 *	12·5

* The drainage area of Loch Maree includes those of Lochan Fada, Lochs Garbhaig, Clair, Coulin, Tollie, Kernsary, and Ghiuragarstidh; and that of Loch a' Bhaid-Luachraich includes that of Loch Mhic' Ille Riabhaich.

The particulars regarding the lochs dealt with in this paper are collected together in the table on p. 568 for convenience of reference and comparison.

From this table it will be seen that in the fourteen lochs under consideration, which cover an area of nearly 15 square miles, nearly 2500 soundings were taken, or an average of 167 soundings per square mile of surface. The aggregate volume of water contained in the lochs is estimated at 44,500 millions of cubic feet, and the area draining into them is 185½ square miles, or 12½ times the area of the lochs.

NOTES ON THE GEOLOGY OF THE LOCH MAREE DISTRICT.*

(With Geological Map.)

By B. N. Peach, LL.D., F.R.S., and J. Horne, LL.D., F.R.S.

THE Loch Maree district presents features of special geological importance relating to the subdivisions of the Archæan rocks, to the topography of the old pre-Torridonian land surface, and to the series of terrestrial movements which affected the north-west Highlands in post-Cambrian time. Throughout the mountainous region, stretching north to Dundonnell forest and south to Achnashellach and Glen Shieldaig, excellent sections are to be found showing the geological structure of that region.

The Archæan rocks (A on map), lying to the west of the great post-Cambrian displacements, occur mainly in the north-west of the area, where they form a broad tract of mountainous ground between Loch na Sheallag and Loch Maree, and westwards by Torrisdale to Gairloch. There is also an important development of them on both sides of Loch Torridon above Loch Shieldaig, and they likewise appear as inliers, surrounded by Torridon Sandstone, as for instance on the southern slope of Beinn Dearg north of Liathach. Within the territory affected by the post-Cambrian movements there are masses of displaced gneiss, of which the most important lies immediately to the north of Kinlochewe; others appear further north on Mullach Coire Mhic Fhearchair, and far to the south on Glas Bheinn, on Torr na h-Iolaire and at Coulags in Glen Carron. Over much of the region they form lofty ground and give rise to prominent peaks, as, for example, Ben Lair (2817 feet), Beinn a' Chaisgein Mor (2802 feet), and Ben Airidh Charr (2593 feet), all north of Loch Maree.

Throughout this area there is a remarkable development of those types of Archæan rocks that have affinities with plutonic igneous products, consisting mainly of massive and foliated, pyroxenic, hornblendic, and micaceous gneisses. Along the northern margin of this district, between Loch na Sheallag and Gruinard Bay, the original characters of the rocks that enter into the fundamental complex are well displayed. The various stages in the separation of the ferro-magnesian from the quartzo-felspathic constituents, and the gradual development of mineral banding in the massive gneisses, are there clearly shown. In that area, also, the intrusive character of the basic dykes traversing the gneiss in a west-north-west direction is proved beyond all doubt. Passing southwards to the tract lying south of Poolewe, both the gneisses and the intrusive dykes have been thrown into an anticlinal fold, which is represented on the geological survey map (Sheet 91). Here

* Published by permission of the Director of the Geological Survey. Map, p. 616.

we find that, under the influence of mechanical stresses, there has been differential movement of the rock constituents, and linear foliation has been developed in the basic dykes—the foliation being parallel with the pitch of the folds. Further south in the Torridon district biotite gneisses prevail, which are traversed by bands of hornblende schist representing the original basic dykes.

Of special interest is the development of crystalline schists, that have affinities with rocks of sedimentary origin, north of Loch Maree and near Gairloch. The prominent members of this series are quartz-schists, mica-schists, graphitic schists, limestones, and dolomites, with tremolite, garnet, and epidote, which are there associated with a massive intrusive sheet of hornblende-schist. Lithologically some of these crystalline schists closely resemble the altered sediments in the Eastern Highlands. The quartz-schists, mica-schists, and limestones, are well exposed in various folds between Letterewe and Glen Tulacha, west of Lochan Fada, pierced by the great sill of hornblende-schist forming Beinn Lair and Beinn Airidh Charr (B^G on map). The original relations of these altered sediments to the gneisses that have affinities with plutonic igneous rocks have been obscured by subsequent earth stresses. But along their outer margin they are bounded by gneiss apparently underlying them, and they are visibly overlain by gneiss with basic dykes, the whole series being affected by a common system of folds.

One of the most remarkable geological features of the Loch Maree district is the evidence relating to the topography of the primeval land-surface on which the Torridonian sediments were laid down. Between the head of Loch Maree and Strath na Sheallag, where the overlying red sandstone has been partly removed by denudation, it is possible to trace the direction of the old valleys and the orientation of the ancient peaks. On the eastern slope of Ben Slioch, near Glen Fhasaigh, the observer may climb one of these hills, which rises to a height of about 2000 feet in the midst of the Torridon Sandstone, and trace the alternation of breccia and sandstone filling the ancient valley. Similar evidence is obtained further north in the mountainous region near the head of Glen na Muic. Where these deeply-eroded valleys are preserved, breccias of local origin frequently appear at the base of the Torridon Sandstone. In the Loch Maree district this formation has been subdivided into three groups: a lower, consisting of epidotic grits, dark and grey shales, with calcareous bands and red sandstones; a middle, composed of a great thickness of false-bedded grits and sandstones with scattered pebbles; an upper, comprising chocolate-coloured sandstones, micaceous flags, with dark shales and calcareous bands. The members of the lower group are well displayed in the district near Talladale and Slattadale, on the south-west shore of Loch Maree; those of the middle group are typically developed in the mountains round Loch Torridon, from which district this system takes its name, while the upper group appears in the islands north of Gruinard. Throughout this region this formation (t on map) reaches a vast thickness, for on the shores of Loch Torridon it rises on Liathach from the sea-level to a height of over 3000 feet. In the mountains between Slioch and An Teallach these sandstones have a gentle dip towards the south-east; in the Torridon district they are nearly horizontal, while further south they form a low arch.

As indicated in our previous notes on the geology of the Assynt district, the Torridon Sandstone is separated from the overlying quartzites by an unconformability, which in some parts of the Loch Maree area is not so prominent as in Assynt. On An Teallach in the Dundonnell Forest and southwards towards Mullach Coire Mhic Fhearchair, the Cambrian quartzites are inclined at a higher angle to the south-east than the Torridon Sandstone. In the area lying to the west of the post-Cambrian displacements we find at various localities the normal

Cambrian sequence in ascending order—1, the basal quartzites (a^1 on map); 2, the pipe-rock (a^2); 3, the Fucoid beds (a^3). This sequence is displayed in the Dundonnell Forest, on the western slope of Ben a' Vuinie near Kinlochewe, on the west declivity of Meal a' Ghuibhais south of Loch Maree, and on Beinn Eighe. Within these limits the Fucoid beds have yielded at several localities well-preserved trilobites and other organic remains of Lower Cambrian age. The Cambrian limestone rarely appears in the undisturbed area; in the displaced masses west of Glas Bheinn towards the head of Loch Kishorn it is largely represented.

The evidence bearing on the post-Cambrian movements obtained in the Loch Maree district is of special interest. On referring to the map, it will be seen that the belt affected by these movements runs southwards from Dundonnell by Kinlochewe, Beinn Eighe, and the Coulin Forest to Glen Carron and Loch Kishorn. Throughout this area the geological structure is extremely complicated, but certain sections may be referred to as illustrating the continual variation in the relations of the rocks. The simplest type is met with in the Dundonnell Forest, where on the west slope of Creag Rainich there are two powerful thrusts running parallel with each other for some distance in a north-north-east and south-south-west direction. West of these lines of displacement the Cambrian sequence is undisturbed from the basal quartzites to the Fucoid beds. On the horizon of the latter the first powerful thrust is met with, which brings forward a slice of Torridon Sandstone with a core of Archæan gneiss. Not far to the east the second thrust supervenes, which ushers in the crystalline schists overlying the Moine thrust-plane. A repetition of this structure in a more complicated form is found in the tract between Glen Fhasaigh and the heights of Kinlochewe, where the mass of displaced gneiss with its intrusive dykes is admirably displayed between the Moine thrust to the east and the outcrop of the Kishorn and Kinlochewe thrust-plane west of Ben a' Vuinie.

In the region stretching south from the head of Loch Maree by Beinn Eighe and the Coulin and Achnashellach Forests to Loch Kishorn the structure is more complicated. For to the west of the two great lines of displacement just referred to, which have been traced south to Loch Kishorn and Glen Carron, the Torridon Sandstone and Cambrian strata have been repeated by a series of inverted folds and minor thrusts. Hence we find strips of Cambrian quartzite alternating with Torridon Sandstone, the strata having a general dip towards the south-east as if they formed part of a normal ascending sequence. The clear sections, however, on Beinn Eighe, on Sgurr Dubh, Beinn Liath Mhor, Sgurr Ruadh, and other peaks, show the overfolding and reversed faults which are the prominent features of the structure of that region. Still further south, towards the head of Loch Kishorn, and west of the slice of Archæan gneiss overlying the Kishorn thrust-plane, there is a constant repetition of the Fucoid beds and Cambrian limestone by inverted folds and reversed faults.

In the Loch Maree district, as in Assynt, there is evidence of the development of new structures resulting from the post-Cambrian movements. The deformation of the Torridon Sandstone, west of the Moine thrust, is well displayed in the stream south of the Kinlochewe Hotel, where the grits have been made schistose, and where the felspars have been partially broken down and reconstructed. Near the outcrop of the Kishorn thrust, west of Glen Carron, the Lewisian gneiss is sheared and rolled out, passing into flaser gneiss and schist with a platy or fluxion structure.

East of the Moine thrust, which runs south from Dundonnell by Loch an Nid, the heights of Kinlochewe, and Loch Coulin to Glen Carron, the area represented on the map is occupied by crystalline schists of a remarkably uniform type. They consist mainly of flaggy granulitic quartzose schists and mica-schists, with prominent

belts of garnetiferous muscovite-biotite schists. The latter are well developed on Fionn Bheinn, north of Achnasheen, and on Sgurr Mor Fannich, where they form conspicuous crags. Near the Moine thrust, and, indeed, for some miles to the east of the plane of that thrust, the Eastern or Moine schists have a persistent dip to the south-east. In the Fannich mountains they are overfolded on a stupendous scale, and similar evidence is obtained in the group of mountains north of Achnasheen.

Reference must now be made to the faults that affected the area after the post-Cambrian thrusts. Of these by far the most important is the great line of displacement that crosses the region in a north-west and south-east direction, coinciding with the long axis of Loch Maree, which may be termed the Loch Maree fault. It has been traced in a north-west direction along the river Ewe, by the south margin of Loch Ewe, towards Loch an Draine, where the Torridon Sandstone on the north-east side is faulted down against the Lewisian gneiss at Poolewe. At Kinlochewe this dislocation has been traced up Glen Dochartie and onwards in the direction of Ledgown. Indeed, the probable continuation of this fault has been recently found far to the south-east—in the basin of the Conon. Where the line of fault is not obscured by drift, it gives rise to a prominent feature on the surface of the ground. This powerful fault shifts the outcrops of the Moine and Kishorn thrust-planes, and likewise of the overfolded strata associated with these thrusts. It further shifts the outcrop of the normal fault in Glen Fhasaigh, which runs in a north-east direction between the head of Loch Maree and Lochan Fada (see map). The continuation of the Fhasaigh fault is to be found in Glen Grudie, on the south side of Loch Maree, so that its outcrop is shifted at least for a distance of 2 miles by the Loch Maree dislocation.

In the north-west part of the area, in Isle Ewe, and in the promontory between Loch Ewe and Gruinard Bay, there is a strip of Triassic Sandstone (*f* on map), thrown down by two powerful faults.

Throughout the Loch Maree district, and especially in the mountainous region embracing the Torridon Sandstone and Cambrian quartzite, there is evidence of intense glaciation. During the climax of the glacial period, even the highest mountains in the Loch Maree district were overridden by the ice. Some of the evidence pointing to this conclusion may here be referred to. Along the top of Ben Slioch (3217 feet), which, as already indicated, is composed of Torridon Sandstone, blocks of thrust Archæan gneiss, Cambrian quartzite, and Moine schists are met with, all of which have been derived from the east. Similar evidence is obtained on Meall Ghuibhais (2882 feet), on the south side of Loch Maree. Again, in the Coulin Forest, on the lofty ridge running south from Sgurr Dubh (2566 feet) to Beinn Liath Mhor (3034 feet), striæ have been recorded pointing in a westerly direction at elevations ranging from 1750 to 2000 feet. Blocks of crystalline schist derived from the area east of the Moine thrust, and occasional fragments of thrust Archæan gneiss, appear on this ridge. Further south on Sgurr Ruadh, ice-markings pointing a few degrees to the north of west occur at an elevation of 2500 feet. The top of Ruadh Stac (2919 feet), on the east side of Glen Kishorn, is finely glaciated, the striæ pointing W. 25° N. The summit of Meall a' Chinn Dearg (3095 feet), composed chiefly of Torridon Sandstones and grits, is strewn with transported blocks of Cambrian quartzite. Similar evidence might be adduced regarding that part of the Applecross area which is shown in the south-west corner of the map. For there, on Beinn Bhan (2936 feet), striæ have been recorded underneath the 2750 feet contour-line trending W. 13° to 20° N. Blocks of the Eastern or Moine schists appear at that level, and are fairly plentiful below 2500 feet. From these facts the inference seems obvious that during the

maximum glaciation, the western part of Ross-shire must have been completely overridden by ice moving in a westerly direction towards the sea.

The westerly flow of the ice is confirmed by the transport of the boulders in the drift deposits, which consist mainly of moraines in the area lying to the west of the Moine schists, and these contain numerous blocks of quartzose schist and mica-schist derived from the east.

After the disappearance of the great ice-sheet there ensued a period of confluent valley glaciers. The direction of the ice-flow during this later glaciation is represented on the map by feathered arrows. On referring to the map, it will be seen that the prominent mountain groups north and south of Loch Maree formed independent centres of glaciation. In many of the valleys there is a splendid development of both lateral and terminal moraines. The closing phases of the glaciation of the region is indicated by the moraines encircling some of the high corries, and by similar deposits resting on the 50-feet beach at the head of Loch Torridon, where they have been recorded by our colleague, Mr. Hinxman.

A glance at the map will show that Loch Maree is by far the largest rock-basin in that district; but as it lies along the line of a powerful fault, which has given rise to a prominent feature in the topography of the region, we prefer not to discuss its features in connection with the theory of the glacial origin of lake-basins.

Lochan Fada is a simple rock-basin resting partly on Torridon Sandstone and partly on Lewisian gneiss. Along the greater part of its course it coincides with an old pre-Torridonian valley, trending in a west-north-west direction. At its eastern end it is bounded by the continuation of the Glen Fhasaigh fault, which brings down the Cambrian quartzite, Fucoid beds, Serpulite grit, limestone, and overlying Archæan gneiss above the Glen Logan or Kishorn thrust plane. The sudden deepening of the loch at its lower end is evidently related to this fault, because harder and more durable strata on the east side of this fault have been brought against the softer Torridon Sandstone to the west. It is important to note that the downthrow side of this fault is towards the east; in other words, the eastern floor of Lochan Fada is not faulted down to the west. It is interesting to note that the deepest part of the basin, and the deepest sounding (248 feet), lie between Slioch and Ben Tarsuinn, where the erosion of the ice during the maximum glaciation would probably be greatest.

Loch Garbhaig, which is situated to the north of Ben Slioch, is a small lake over a mile in length, and evidently a rock basin from the appearance of Lewisian gneiss at its exit, where it is drained by the Amhainn na Fuirneis. The soundings prove the existence of two basins separated by a ridge, the eastern one reaching a depth of 93 feet, and the western 50 feet close to its outlet. This lake lies mainly along the junction of the Archæan rocks and Torridon Sandstone, the older rocks forming the greater part of the north shore, and the red sandstone the larger part of the south margin. A tongue of Torridon breccia occupies a hollow in the Archæan rocks on the north shore, where it rests on a mass of hornblende-schist. This breccia appears in an island in the loch, which forms part of the ridge separating the two basins. The loch may therefore be regarded as a rock basin eroded by ice, mainly out of Torridon Sandstone along its line of junction with the Archæan floor.

Loch Kernsary is very irregular in shape, and has four basins below the 50-feet level, the deepest sounding—93 feet—being found near its north-west extremity. The Archæan gneiss forms part of its north-east shore, while the Torridonian rocks floor the remaining portions, save near the west limit of the north shore, where a boss of Lewisian gneiss projects through the Torridon Sandstone. As the Torridon sandstones and conglomerates dip at angles varying from 20° to 35° to the north-west, we may infer that those sediments are resting on a very uneven floor of

gneiss. The bed of the lake, therefore, may here correspond with the pre-Torridonian surface, the softer Torridon Sandstone being more easily removed than the more durable gneiss. Striæ pointing in a north-west direction are found round the lake, the trend of which is slightly oblique to the long axis of the loch, but almost parallel to that of the 50-feet basins. The latter in turn have their longer axes somewhat oblique to the strike of the Torridonian strata.

Loch Ghiuragarstidh is a shallow loch lying along the strike of the Torridon Sandstone, with an exposure of Lewisian gneiss near its outlet, its greatest depth being 37 feet. A long ridge of sand and gravel, probably a moraine, occurs near its mouth, so that this lake may lie partly in drift and partly in rock.

Loch Tollie is a true rock-basin of very irregular shape, surrounded by Lewisian gneiss, the deepest sounding being 86 feet. This basin belongs to the shallow plateau type so common in the Archæan area in the west of Sutherland. Its irregularity is due to the folding and intense shearing of the component members of the Lewisian gneiss in that region. Glacial striæ are met with at several localities round the loch, varying in direction from W. 10° N. to W. 41° N. The dominant strike of the foliation of the gneiss is west-north-west and east-south-east. The long axes of the bays of the loch are more in accordance with the direction of the ice-flow than with the strike of the foliation.

Loch Clair lies partly in moraine drift and partly in thrust Torridonian strata. Drift occurs at the outlet and along its western margin, and all the islands are composed of moraines.

Loch Coulin is separated from Loch Clair by an alluvial fan brought down by Allt na Luib. The river Coulin has silted up the greater part of the upper end of the lake, and its limits have been still further restricted by detritus borne downwards by the streams on the north.

THE EVOLUTION OF CLIMATES.

In a paper under this title, reprinted, with additions, from the *American Geologist*, August to October, 1899, Mr. Marsden Manson propounds yet another theory to account for the warm and cold periods of geologic time, as recorded by evidence of past distributions of flora and fauna and of glacial action. The main point of the theory is a return to the now universally abandoned hypothesis of the control of climate, since the advent of living organisms, by heat conducted from the interior of the Earth. "*Earth-heat* controlled surface temperatures during its prevalence, and by the laws of cooling solids was uniformly distributed at sea-level; it was held near the planetary surface by the enshrouding media, by which it was trapped, and through which it escaped slowly, not by direct radiation, but by the performance of work, namely the evaporation of water, and by convective currents which carried warm air to the upper regions of the atmosphere, from which regions only could free radiation of heat into space take place. *Solar* energy did not directly affect surface temperatures during the existence of earth-heat as a sensible factor, by reason of the intervention of a dense cloud-sphere incident to the universally warm oceans whose temperature is attested by early fossil life; but during this period solar energy acted as a conservator of planetary heat by warming the upper regions of the atmosphere and clouds." . . . "Land areas reached glacial temperatures earlier than ocean areas, by reason of the low specific heat of earth and rocks, their more intense rate of radiation, through the cooling action of rain and snow, and by reason of greater elevation." . . . "They were subjected to maximum glaciation along lines of maximum precipitation, and may

have escaped all but light local glaciation in regions of maximum cloud formation and precipitation." . . . "Upon the cooling of the oceans, the effective remnant of earth-heat was exhausted and cloud formation reached a minimum, permitting solar energy to reach the surface and to assume domination and control of its temperatures." " . . . The climates of such control became zonal by reason of direct exposure to a zonally distributed source, and these climates gradually rose in temperature by reason of the trapping of heat rays emitted by the warming planetary surface; such rise is yet in progress, as recorded by retreating glaciers and advancing plant and animal life." All evidence of glacial action in pre-Tertiary times is dismissed as local and due to elevation alone.

We confess that Mr. Marsden's paper leaves us altogether unconvinced. It is difficult to regard the view that the climate of the whole globe was of uniform slowly falling temperature up to nearly the end of the Quaternary glacial period as established, but Mr. Marsden merely quotes some authorities in support, and deals with no difficulties. If we accept it, it does not seem easy to explain the survival of warm-climate animals and plants during a non-zonal glacial period. But the chief obstacles to the establishment of Mr. Marsden's theory lie in the domain of atmospheric physics. Assume the rather incredible cloud-covering; then inside we have uniform temperature, and therefore, presumably, no circulation. Nevertheless, the regions of maximum and minimum precipitation are taken to be the same as they appear on modern rainfall maps, which are quoted, and these regions are determined by modern zonal circulation. Again, the uniform temperature inside the cloud-covering, which we may suppose began when water-vapour was first condensed, is said to give place to a difference of temperature due to the land surface cooling faster than the sea. This difference must have gone on increasing, and by Tertiary times have become very considerable, yet it apparently produced no circulation. One would expect something of the nature of winter monsoon conditions, only permanent all the year round: the winds would everywhere blow seaward; on the sea there would be ascending air and constant precipitation, as in the equatorial belt of modern times; on the land descending air, no rainfall, and a hole in the essential cloud-cap, as in the modern tropical belt. Lastly, it is admitted that solar radiation is "zonally" effective on the outer, or upper, surface of the cloud-cap. Hence, in the upper atmosphere there would be a planetary circulation undisturbed by any land and sea influences, and strongly developed just in proportion as the cloud-cap was effective in shutting off solar radiation from the lower atmosphere. But we are to suppose that this circulation went on without producing any effect on the cloudy surface, or inducing any motion in the levels below.

THE FIFTH ITALIAN GEOGRAPHICAL CONGRESS.*

The Fifth Italian Geographical Congress took place at Naples between April 6 and 11 of the present year, and was attended by 220 members, mostly from various parts of Italy, but including also a few from other countries. The arrangements had been carried out under the active superintendence of Prof. Porena of Naples, and the programme included excursions to Pompeii, Capri, and other places round the Bay of Naples, while two exhibitions—one cartographical, the other Vesuvian—had also been organized. Important maps, including two embodying new topographical surveys of Vesuvius, were presented by the Military Geographical Institute.

* Communicated by Prof. Guido Cora, who represented the Society at the Congress.

After a preliminary meeting, at which Prof. Porena was unanimously elected president, the inaugural meeting took place on the afternoon of April 6, the opening address being delivered by Prof. Orlando, Minister of Public Instruction, in the name of the king. Prof. Porena's address, which followed, gave a brief but clear summary of the progress of geography in Italy down to the present time, dealing especially with the important part played by Naples in the history of cartography from the eleventh century onwards, and in the modern colonial undertakings of Italy. Prof. Cora subsequently conveyed to the Congress the greetings of the Royal Geographical Society, and spoke of the successful issue of the National Antarctic Expedition.

The Congress was divided into four sections, viz. (*a*) Scientific (mathematical geography, cartography, physical geography, and exploration); (*b*) economic and commercial (emigration, colonization, etc.); (*c*) educational; (*d*) historical (history of geography and cartography). The total number of papers and communications was 107, while the votes passed numbered 51. It is possible here to refer only to some of the more important questions dealt with.

In the scientific section, physical geography engaged the largest share of attention, but there were also some important communications on ethnography, cartography, bibliography, and on the better transcription and orthography of geographical names. Recommendations were addressed to the Military Geographical Institute of Florence, (1) for the extension to the whole of Italy of the surveys on the scale of 1 : 25,000; (2) for the preparation of a chorographical map of Italy on the scale 1 : 200,000, with an indication in colour of woods and copses; and (3) for the completion of the topographical survey of Eritrea. The paper by Prof. F. Musoni on the scientific investigation of caves * and another by Prof. F. Porro on the present state of research in regard to Italian glaciers,† attracted much interest and were followed by instructive discussions. A preliminary report, full of important notes, was presented by Prof. L. Palazzo on the limnological stations established by the Italian Geographical Society on the Lake of Bolsena, to which reference was made in the October number of the *Journal* (p. 476). A paper on the limnology and depressed areas of Italy was also presented by Prof. O. Marinelli. Amongst other noteworthy papers on physical geography, we may mention the following: "On the Systematical Study of Landslips in Italy," by R. Almagià; "On Earthquakes and Underground Air," by Prof. G. Uzielli; "On the Study of Thalassology in Italy," by Prof. L. Marini; "On Potamological Research," by Signor De Magistris.

A proposal having been made by Signor A. Baldacci to form an international committee for the preparation of an ethnographical map of the Balkan peninsula, Prof. Cora read a paper on the ethnography of Croatia and Servia, based on his journey in those countries in 1902, showing that the Bulgarians and Albanians, although they have mostly adopted the habit and language of the country, are still very numerous in southern Servia, a fact not brought out by the official publications, which quote only the language now spoken.

In the economic-commercial section many of the communications, *e.g.* those of Profs. V. Grossi, A. Blessich, and Forrano, had to do with the countries of South

* As a result of the vote urging the Italian Alpine Club to promote the formation of speleological clubs or commissions, a "Circolo Speleologico" has been formed in Rome, with Prof. Guido Cora as president and Dr. E. Abbate as secretary.

† The permanent Committee of the Italian Geographical Congresses (Rome), at its meeting of June last, decided, in accord with the Italian Alpine Club, that a special committee should be appointed for the study of Italian glaciers.

America, to which the commerce and emigration of Italy is so largely directed, viz. Brazil and Argentina. Others dealt with the principles and methods of emigration (Prof. B. Frescura); the commerce, agriculture, and railways of Eritrea (G. Buonomo, G. B. Penne, Prof. A. Roncali); and with forestry in the Balkan peninsula (A. Baldacci). A communication was made by Signor L. Cufino on the road from Assab to Æthiopia through the valley of Golima (based on a paper by Prof. Cora); while Signor M. D'Amelio gave some account of recent explorations in the interior of the Dankali country by the Italian officers, Oglietti and Pántano, and the Resident of Assab, which will throw new light on the geography of this little-known country; Prof. Cora adding some notes on the first Italian explorers in this region.

In the section for education many important discussions took place, mostly bearing on the improvement and extension of geographical teaching in the Italian universities, in naval and military institutes, and the like.

It is impossible to mention all the communications presented to the historical section, many of them of quite a special character. Among the most interesting we may notice those of Prof. Uzielli (combating the views of Gonzales de la Rosa and Vignaud as to the authenticity of Toscanelli's letter, and urging the publication of the contemporaneous Vespucci Codex); of Prof. Bruzzo (on the work performed by L. F. Marsigli); of Prof. Crinò (on a manuscript portolano of the seventeenth century); papers relating to Sicily (by Prof. Crinò, G. D. Vita, and Prof. A. Enrile), and to the "Ager Picentinus" (Prof. L. Foglia). Prof. G. Grasso spoke of the life of Captain Cook; and a paper was also presented on the Italian origin of the nautical compass, attributed by Dr. L. Posteraro to Salomone Ireneo Pacifico (778–846).

Besides the work of the separate sections, three lectures were delivered before the Congress as a whole. The concluding general meeting took place on April 11, Venice being selected as the place of meeting of the next Italian Geographical Congress (1907). It is hoped, however, to hold a special Colonial Geographical Congress in Asmara in September, 1905, with a view to making the colony of Eritrea better known than at present.

REVIEWS.

ASIA.

The Philippines.

'The Gems of the East.' By A. Henry Savage Landor. In 2 vols. 8vo, pp. vi., 328 and 460. *Illustrations and Map.* London: Macmillan. 1904. *Price*, 30*s*.

Mr. Landor's book opens with the sentence, "Follow me, and you will travel quickly." He is speaking of his journey to the Philippine archipelago, the subject of the volumes before us, and his desire to lose no time in getting on to the ground cannot be regarded as other than praiseworthy. But the reader soon finds that this motor-car ideal of travel is not limited to the crossing of the two oceans and the American continent, but is adhered to throughout the journey. The excellent map of the Philippines, given at the beginning of the first volume, is crossed and recrossed in all directions with the red lines which depict the author's route. He tells us that in the 250 days he spent in the archipelago he covered over 16,000 miles.

For the most part Mr. Landor's journeys consisted in going from island to island and touching at their innumerable ports, but he also crossed Cebu, Negros, and Panay, and made some lengthy land journeys in northern Luzon. It was in Mindanao, however, that he was in least frequented paths. Here he saw some fighting, accompanying the American forces on the occasion of the taking of Fort Bacolod, on Lake Magindano, and afterwards continuing his route northward to Iligan bay. He also crossed the island in two other parts—in an easterly direction from Kota Batu (Cottobatto) to Davao along a very little-known trail, and from south to north from the last-mentioned place to Butuan *viâ* the Agusan valley, a journey first made, if we remember right, by Montano in 1880, and later by various travellers. Mr. Landor is no naturalist—he talks, it may be remarked *en passant*, of "trees of the genera *Ficus elastica* and *palaquium*," and of "a specie"—but he appears to have taken considerable interest in the numerous tribes with whom he was brought in contact, and furnishes a number of somewhat elaborate tables of measurements, though such value as these have is lessened by its not being stated whether they are of one, or the mean of many, and if so, how many individuals. Of all the tribes described, the Igorrotes and Tagbuanas—or, as the author prefers to call them, Tagbanouas—are perhaps the most fully dealt with. The former, he thinks, are related to the Ainus, a sufficiently curious affinity, if true; while the Tagbuanas, he considers, "have many Australoid or Papuan characteristics about their features"—a sentence which, if it means anything, can only be interpreted as implying Australian and Papuan to be of the same stock. The ethnologist will find a good deal about a number of by no means well-known tribes, but he will perhaps wish that the details had been recorded with more scientific preciseness. The deciphering of the puzzle of the races and peoples of the Philippines is no easy task, and can only be accomplished with the aid of more accurate data than a rapidly moving traveller can afford, however great his diligence.

From Mr. Landor's pages a tolerably clear idea of the position and work of the Americans can be gathered. He points out that, whatever his faults, the Spaniard had at least the merit of doing everything in the way of public works, and especially roads and bridges, on solid and permanent lines, while his successor does but little in this way, and hopes to civilize the native on a curriculum of literature, history, and the higher mathematics. Drinking-saloons are too numerous, and in other respects America has still a good deal to learn in the art of managing a colony. The author, however, has not especially laid himself out to record the present-day condition of the islands so much as to describe the episodes of his journeys and the peoples with whom he was brought in contact. The volumes also contain a great number of remarks on the reefs, shoals, and cays, and the soundings over them. There are also numerous notes on diseases, though here the reader will occasionally find things which do not occur in the text-books, as, for example, the statement that the Filipinos "are not yet foolish enough to hold mosquitoes responsible for the introduction of malarial fever."

F. H. H. G.

Research in the Malay Archipelago.

Siboga-Expeditie. Uitkomsten op zoologisch, botanisch, oceanographisch en geologisch Gebied verzameld in Nederlandsch Oost-Indië 1899–1900 aan boord H.M.S. *Siboga* . . . uitgegeven door Dr. Max Weber.' [To be completed in 65 monographs.] Leiden: E. J. Brill. 1901—.

The expedition of the Danish man-of-war *Siboga*, which spent about a year (March, 1899, to February, 1900) in the scientific exploration of East Indian waters, adds another to the now numerous researches within limited areas which during the

last few years have been gradually filling in the details of the main outlines sketched by the great deep-sea expeditions, like that of the *Challenger*. The reports of the *Siboga* Expedition are to be issued in sixty-five parts, of which we have now before us the narrative of the voyage, the parts describing the ship and its scientific appliances, and the account of the hydrographic results.

The history of the expedition is set forth by Prof. Dr. Max Weber, its scientific director, in an extremely lucid introduction to the "Narrative." There has never been any lack of interest amongst Dutch scientists in the great problems of those regions, which may perhaps be not inadequately summed up as the question of "Wallace's Line," the question of the true boundary between Asia and Australasia. Direct contributions to the hydrographic side of this question were made by the *Challenger* and *Gazelle* expeditions; but it was evident that detailed surveys of the bed of the seas, and of their fauna and flora, must be made, and this need was specially impressed upon the public of Holland in articles by Hubrecht (1889) and Kan (1888 and 1895), and by the constant activity of Mr. Treub, the director of the Botanic Gardens at Buitenzorg. The matter was finally taken up by the *Société pour l'encouragement des explorations aux Colonies néerlandaises*, and in 1898 the Government of the Dutch Indies placed the *Siboga* at the disposal of Dr. Max Weber, who was appointed director of the expedition. The *Siboga* was at that time being completed in the Government dockyard at Amsterdam. She was equipped with appliances and machinery before setting out, and left Amsterdam in December, 1898, under the command of Lieut. G. F. Tydeman, of the Dutch navy. Batavia was reached on February 7, 1899, and on the 11th the *Siboga* left for Surabaja, where guns and ammunition were put ashore, and fitting out for the scientific work of the expedition completed. The expedition itself was divided into three voyages—March to May, 1899; June to October, 1899; and October, 1899, to February, 1900; and the ship returned to ordinary service on March 16, 1900.

Dr. Weber's "Narrative" contains a general account of the work of the expedition, and deals in detail with the results of the soundings, the discussion of zoological and other special questions being reserved until the material collected has been worked up. We may note as of particular interest the soundings in the Strait of Lombok, which showed a ridge between Bala and Lombok with a maximum depth of 312 mètres, and the survey of the southern part of the Strait of Makassar. The work of the expedition in the Banda sea is also of immense value; the clearing-up of its relation to the Ceram sea and Molucca passage, the discovery of the "Siboga ridge," with the disproof of the existence of the supposed "Weber deep," the definition of the lenticular depression west of the Kei islands, and the discovery of deep-water communication between the Banda sea and the Flores and Bali seas, all afford new and precise information about a region of great complexity. The report on the geological investigations, which is in the hands of Dr. A. Wichmann, will doubtless throw much light on the complex disturbances to which the remarkable configuration disclosed is due. Dr. Weber's "Narrative" is full of suggestive observations on matters zoological, botanical, ethnographic, and so on; we only regret the absence of a summary of results, especially of the soundings, which would save the considerable trouble of extraction from the general text.

In the second monograph, Lieut. Tydeman describes the ship and the scientific appliances used. The equipment was provided after consultation with such authorities as Prof. Chun, Prof. Hensen, and Dr. Schott, and seems to have been adequate and satisfactory, although there are no novel features of interest, except in matters of detail.

The third monograph, on hydrographic results, is also by Lieut. Tydeman. The most important contribution in the volume is the two charts in which the

soundings of the *Siboga* are combined with those derived from other sources. These maps are discussed by Dr. Weber in his "Narrative," and, except for the table of soundings, Lieut. Tydeman's monograph contains little but notes on navigation of the ordinary "sailing directions" type. We have been unable to find any account of temperature observations, although Dr. Weber makes considerable use of these, or of the collection of water-samples for chemical examination. The list of forthcoming monographs does not seem to include any further reports on physics and chemistry; but we can hardly suppose that these branches have not received full attention, and, in view of the remarkable results of the soundings made by the expedition, we look forward to a report on physical and chemical observations with the greatest interest.

AUSTRALASIA.

Among Pacific Islands.

'Chez les Cannibales: Huit Ans de Croisière dans l'Océan Pacifique à bord du Yacht *Le Tolna*.' By Count Rodolphe Festetics de Tolna. 4to, pp. iv., 407. *Illustrations and Maps.* Paris: Plon-Nourrit. 1903.

'Vers l'Écueil de Minicoy.' By Count Rodolphe Festetics de Tolna. 4to., pp. 395. *Illustrations and Maps.* Paris: Plon-Nourrit. 1904.

These books, though bearing different titles, are in fact the two volumes of one and the same work, and may therefore be considered together. An only too common fault of books of travel at the present day is that the author gets over his ground at express speed, and has but little opportunity of acquiring any real knowledge of the country through which he travels. No accusation of this nature can be brought against the writer of the volumes before us, for no less than eight years intervened between the commencement of the yacht's cruise at San Francisco and her loss on the reefs of Minicoy. It is true that two of these years were spent in Japan, and lengthy visits were paid to other parts of the world which are familiar ground, but a large proportion of the time was occupied in cruising in the less-known waters of the Bismarck archipelago, the Solomon islands, the New Hebrides, Santa Cruz and various Melanesian islands. In mid-Pacific Fanning, Rakahanga, and many other islands were visited before reaching the usual goal of tourists, Tahiti and Samoa, at which latter place, it may parenthetically be remarked, the author had the good fortune to meet "Stevenson, *le célèbre écrivain américain*"!

Count Festetics himself navigated his little yacht—a schooner of 76 tons—and in a great part of his Melanesian cruise must have been in very imperfectly surveyed waters, notably on the east coast of Bougainville. His wanderings in these regions might have added a good deal to geographical knowledge, but unfortunately Count Festetics is in no sense a scientific traveller, and hence many golden opportunities have been lost. He describes what he sees, however, clearly and graphically enough, and manages to see a good deal, so that the ethnologist will find his pages by no means barren, still less the student of anthropophagy, a custom which appears to have an extraordinary fascination for the author. The chief merit of the book lies, nevertheless, not so much in its letterpress as in its illustrations. These, which are process blocks from photographs, are not only extremely numerous, amounting to nearly four hundred in number, but for the most part of unusual excellence. They are certainly the best examples as yet published of the islands extending from the Santa Cruz group to the Admiralty islands, and afford an abundance of types, many of which are admirable. The large size of the page, moreover, admits of correspondingly large subjects, such as the duk-duk ceremony, dances, etc., being well shown. When it is considered that

in many cases the taking of these photographs must have been attended with no little risk, and was always under very unfavourable climatic conditions, their success is remarkable. They afford a fund of material for the ethnologist which alone contains more information than most books on this region, especially as a large number of articles of dress, ornaments, etc., etc., are figured.

The latter portion of the Tolna's cruise, culminating in her loss on Minicoy, calls for no special remark. It is in Melanesia, as we have already said, that the main interest of the book centres, and the leisurely character of the yacht's progress gave opportunities of observation such as the ordinary traveller seldom obtains. The result is a record of native manners and customs which, though not the contribution of a scientific observer, is by no means without value. Certain parts of it, however, ought never to have been written. That cannibalism exists in various parts of the world is an unpleasant fact which for the present has to be accepted, and within decent limits it is a legitimate subject for study at the hands of the ethnologist. But that any person calling himself a civilized being, as Count Festetics presumably does, could deliberately induce savages to take him on a cannibal expedition for the express purpose of seeing defenceless persons massacred and eaten would be absolutely incredible did we not find it recorded by the author himself *in extenso*, and without any apparent sense of shame or horror. Against actions such as these no protest can be too strong.

F. H. H. G.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Economic Geography.

'The Geography of Commerce.' By Spencer Trotter, M.D. New York: the Macmillan Company. 1903.

'Allgemeine und specielle Wirtschaftsgeographie.' By Dr. Ernst Friedrich. Leipzig: G. J. Göschen'sche Verlagshandlung. 1904.

"Die Fortschritte der Anthropogeographie" (1891–1902). By Dr. Ernst Friedrich. (Pp. 261–298 of vol. xxvi. of the *Geographisches Jahrbuch*.) Gotha: Justus Perthes. 1904.

The two books and the paper whose titles are given above can hardly fail to impress upon the reader how much it is to be desired that geographers should come to agree on some definition of geography that should clearly indicate its scope. The two books deal with the same subject, but they avowedly adopt different points of view. They both contain some rather vague and obscure generalizations in setting forth these different points of view. The differences in the method of treating the subject in the special portions of the two books are, nevertheless, not so great as one might expect from their professed differences in the manner of regarding it.

Trotter's work is one of a series entitled Macmillan's Commercial Series, edited by Cheesman A. Herrick, PH.D., Director of the School of Commerce, Philadelphia Central High School. According to the editor, "The 'Geography of Commerce' fixes the attention on the Earth as an agent in the production of commodities upon which human life depends." It "was prepared to make clear the present conditions of trade, but with the attention fixed primarily on the physical laws and facts by which it is influenced" (pp. xv.–xvi.). According to the author, "Geography, as distinct from physiography, includes not only the physical environment, but the human element as well," and "the geography of commerce sets forth the things that the Earth does or is made to do, in supplying the material needs of men" (pp. 1–2).

In the work of Dr. Friedrich the general section, which extends to 82 out of 329 pages (exclusive of index and preliminary matter), is that on which chief stress

is laid by the author, who endeavours, with engaging modesty, but with the assured conviction natural to a serious scholar, to show that he has adopted an entirely new method of dealing with his subject matter, and that the adoption of this method is of prime importance is the study of economic geography. His point of view is set forth chiefly in the first thirty-three pages of his 'Wirtschaftsgeographie,' and is expounded in a similar manner in pp. 261–266 and 291–298 of vol. xxvi. of the *Geographisches Jahrbuch*. The chief distinction between his point of view and that of other writers on the subject is that he places man as a being carrying on economic activities in the foreground (p. 3), and gives a secondary place to natural conditions and relations (*Naturverhältnisse*). He expressly repudiates the conception of the function of economic geography "inaugurated" by W. Götz and followed by A. Kraus, S. Günther, and others, on the ground that they all start from the natural relations instead of the economic activity (*Wirtschaft*), which he describes as the one-sided anthropogeographical point of view (*Geog. Jahrbuch.*, pp. 296, 297), and he defines economic geography as "that branch of anthropogeography in the wider sense which has to consider the mutual relations between nature and man *essentially from the side of man*, without, however, neglecting the natural conditions" (p. 17). The italics represent the spread lettering by which the original lays special emphasis on this phrase. But even when this emphasis is duly recognized, this definition does not seem to indicate a point of view vitally different from that adopted by others who have treated the same subject. It is not essentially different from the clearer and more concise definition quoted above from Trotter, whose work, nevertheless, is stated to give the first place to the Earth. If undue emphasis is laid on the phrase to which Dr. Friedrich attaches special importance, the author may be taken to look upon economic geography rather as a branch of economics than of geography; yet he expressly states that the fact that considerations of place belong to the essence of this study distinguishes economic geography from political economy ('Wirtschaftsgeog.,' p. 17; *Geog. Jahrbuch.*, p. 266).

In order to ascertain what is distinctive in Dr. Friedrich's point of view, the further development of his idea must be considered. The being whose economic activity is the object of anthropogeography is a being in process of evolution. Like the lower animals, he is subject to restraints imposed by nature (*Naturzwang*), but there is this great distinction between the two, that whereas the lower animals carry on their struggle with the forces of nature to satisfy their wants by bodily attributes acquired through adaptation, man carries on the struggle also with the aid of resources outside of his body, tools and implements, which he acquires by economic activity (pp. 13, 14). The greater his command of such resources, the further is he removed from the restraint imposed by nature, the higher the economic stage to which he has risen (p. 19). Four stages are distinguished. The first is the stage of animal economy (*tierische Wirtschaft*). In this stage bodily adaptation prevails; implements are little used, and then only through an instinctive or reflex action. Man satisfies his wants merely by collecting, and is in complete dependence on nature in respect of place, time, quantity, and quality (p. 20). The second stage is that of instinctive economy (*instinktive Wirtschaft*), in which, under the guidance of instinct, man, with the aid of a greater number of implements, begins to free himself from the restraints of nature as regards time, place, quantity, and quality. Advances are made in stock-rearing and agriculture. The density of population at this stage, however, is mostly small, and subject to great changes in place and time. In the case of stock-rearers the settlements are constantly being changed, in that of agriculturists frequently (pp. 21, 22). A third and higher stage is reached when the experiences of each generation are systematically handed on to the next, either orally or, still better, in writing. This is the economic stage of

tradition. The density of population among the agricultural nations in this economic stage is in all cases considerable, mostly extraordinarily great, but rather in consequence of the reduction in the wants of the individual than through the attainment of a high economic level. The advantages of commerce are fully utilized (*ausgenutzt*), and at the terminal and crossing points of the trade-routes the towns (*Siedelungen*), all fixed in situation (*durchweg fest*), swell to huge dimensions (pp. 22–24). The fourth stage is that of science, in which man, working with all the means placed at his disposal by experiment and insight, presses slowly but surely towards his ends, the complete knowledge of natural and human relations and their mutual reactions, and through that knowledge to the control of them. Economic activity, with the aid of science, attains a certainty and rationality which goes far beyond that of the economic stage of tradition. The density of population at this stage is high, in some cases very high, with a relatively high individual standard of living in consequence of the great intensity of the economic activity, and it is constantly increasing in correspondence with the steady increase in that intensity (pp. 24, 25). These four stages are not indeed sharply marked off from one another. There are transitions between them (p. 25), just as there are between animal and human activity (pp. 14, 15). Still they are sufficiently defined to be indicated by the author on one of the three maps at the end of his book, and considering all that is said about the fourth economic stage, one is somewhat surprised to see what an extensive area of the globe is coloured with its tint. The other two maps show respectively the distribution of the forms of economic activity (collecting of vegetable products, fishing, hunting, agriculture, stock-rearing, mining, manufacturing industries, transport, and the investment of capital), and the distribution of economic zones (based chiefly on climate).

It is to these maps, and the general considerations on which they are based, that the author attaches most importance in the study of economic geography; but it may well be questioned whether a map which, for example, places the more backward parts of Asia Minor in the same economic stage as China, with its highly productive agriculture maintained in parts by irrigation works as perfect as those of Egypt, its ancient and elaborate banking system, whose ramifications extend from the leading centres to the remotest provinces of the empire, its cities, which were hoary with antiquity when Rome was young, and some of which are still without the slums that form so lamentable a feature of the cities belonging to the regions in the "scientific" stage of economic development, is likely to be of much service to students of the subject with which the book deals.

In the special part of the work the application of the general considerations is not a prominent feature. That is left for the most part to the student. What characterizes this portion of the book is its extraordinary wealth of accurate detail, but with little attempt to indicate (apart from figures) the relative importance of the details, or to point out either geographical or other influences affecting the economic development. The facts are for the most part merely enumerated. The statement that the ports in British South Africa are "Port Nolloth, Cape Town (84,000 inhabitants), Mossel Bay, Port Elizabeth (23,000 inhabitants), East London (10,000 inhabitants), Port Natal (Durban), 48,000 inhabitants" (p. 281), is typical. Where explanatory notes are given, they are as frequently geographical in the proper sense of the term as explanations in which prominence is given to man as an economic agent.

In Trotter's work there is much less expenditure of systematizing energy, but in general a much more luminous, interesting, and instructive treatment of the matter in hand, and especially in the section on the United States, to which fully one-third of the book is devoted. In the selection and setting forth of details there

is more regard to perspective than in Dr. Friedrich's work, and while the importance of local conditions and place relations is brought out with as much fulness as the limits of his work permit, the influence of man's action in modifying the value of such conditions and relations is indicated with more clearness and precision than in the vague generalizations of the German scholar. Trotter's work is illustrated by numerous maps and diagrams, many of them of the kind with which Cyrus Adams's work on *Commercial Geography* first made us familiar. Other excellent features of the work are the questions and topics for consideration and the lists of books to be consulted (sometimes with references to the precise pages), the more important being distinguished by stars and double stars, printed at the end of each chapter. Altogether this is one of the most valuable books on the subject that have been published, more particularly for American students. Both books are provided with good indexes.

G. G. C.

GENERAL.

Vasco da Gama.

'Le Comte-Amiral D. Vasco da Gama.' Par D. Maria Telles da Gama. Roger & Chernoviz, Paris. 1902. Pp. xxvi, 339, *with fifteen illustrations and a map of Da Gama's voyage.*

It would not be wise to expect too much from every volume with a noble title, an attractive exterior, a capacious page, and a loud-speaking preface written by a distinguished man. And so we will not expect too much from the book of D. Maria Telles da Gama. It is ushered in with words of commendation from Luciano Cordeiro; it is admirably printed, illustrated, and papered; it has all the appearance of furnishing us with an authoritative and up-to-date biography of a national hero; but its promise fades into something very dim in the way of performance when it is seriously examined. For one thing we must be grateful—for the complete French version of the famous 'Roteiro' of the voyage of 1497–9, which is given at the close of the volume (pp. 257–328). But the writer is surely mistaken in thinking that a translation of this invaluable authority justifies her in evading all independent treatment of the great expedition, and that seven pages of gossamer-like construction (19–26), mostly dealing with pleasant little stories bearing on the venture of 1497–9, can possibly be accepted as adequate treatment. The present volume, in fact, is not a serious life of Da Gama at all. It contains 339 pages, and of these barely 130 (with the 'Roteiro') can be considered as in any way biographical of D. Vasco. There is a dedication to Menelik, Emperor of Ethiopia, and a eulogy of that potentate; there is a lengthy comparison of the Portuguese Abyssinian expedition of 1541 and the British invasion of 1868; there is a vigorous *tu quoque* reply to English strictures on Portuguese misgovernment in India; there is a detailed and honest confession of the unfortunate translation of relics that were not Vasco da Gama's, from Vidigueira to Belem in 1880; but there is no attempt at a real life of the famous, stern, and cruel pioneer of European empire in India, based on fresh study of original material, or even on a careful representation of what has been hitherto put forward. Lastly, it is unfortunate that certain ungenerous criticisms on the first Christian dominion in East Indian seas, should lead to so large an expenditure of controversial ink in reply. 'L'Angleterre par système, contrairement à d'autres nations qui par habitude taisent leurs gloires,—porte aux nues ses exploits et dénigre les actions des autres peuples, si héroique soient-elles. . . . L'Angleterre épuise par des impôts brutaux une race décimée par la peste et par la famine et la conduit à la ruine et à la mort . . . 'If

ever rebellion was justified, it is in British India. Never did a tyranny more intolerable oppress an unhappy people.' 'C'est un Anglais qui parle et qui a le courage de dire la vérité.' Rather more of what used to be called 'temper' is advisable in advancing even the best-founded accusations.

C. R. B.

THE MONTHLY RECORD.

EUROPE.

Yorkshire Coast Erosion.—Sir Clements Markham was present as a guest at a meeting of the East Riding Antiquarian Society, held at Hull on October 3, and spoke to the members of the important work to be done in the way of research into the changes to which the coasts of England have been subject within historical times, a study which, as our readers are aware, has been taken up on his initiative by the Research Department of the R.G.S. He referred in particular to the valuable help that might be rendered by antiquaries in the matter, in view of the light thrown on such changes by an examination of early records. The Yorkshire coast from Flamborough head to the Humber, and the tidal waters of the latter, had, he said, been chosen for the first section of the inquiry, and much might probably be learnt in regard to the encroachments of the sea in this region by an examination of monastic and other records, the Priory of Swine having formerly held estates on the Holderness coast. It was known that several villages whose names occurred on old maps had disappeared, though little information was to hand as to their exact positions or the dates of their disappearance. Among other lost areas was the port of Ravenspur, where Henry of Bolingbroke landed to usurp the throne. As regards the Humber, much might be elicited by a study of the long series of maps and charts from Saxton's Atlas down to the present day. The gradual increase in size of the sunken island might in this way be traced, while no less interesting would it be to study the changes in the lower courses of the rivers debouching in the Humber as far as tidal influence extended, with the morasses and islands which were in turn formed. In a paper subsequently read, Colonel Saltmarshe referred to changes which had taken place within the last century on the Humber and lower Ouse.

Projected Trans-Pyrenean Railways.—A note in the supplement to the *Tour du Monde* for September 3 describes the steps lately taken to bring to a practical issue the idea of through railway communication across the range of the Pyrenees which has been in the air for the last twenty years. In 1885 a convention was signed between the French and Spanish Governments for the purpose of furthering the construction of two separate lines, the one across the western part of the range, from Oloron to Jaca by the Col de Canfranc, the other further east, from St. Girons to Lerida by the Col de Salau. It was, however, never ratified, and no further practical steps were taken until last year, when a new joint commission was appointed to examine the question. The recommendations of this commission, which have been accepted by the two Governments and embodied in a new convention, are to the effect that three separate lines (including the two originally proposed) should eventually be constructed, but that the first to be taken in hand should be the newest project—that of a line from Ax-les-Thermes to Ripoll, affording a direct route from Toulouse to Barcelona, and also facilitating communication between France and Algeria by way of Carthagena and Oran. The next in importance is considered to be the Oloron—Jaca line, which will greatly improve the communications between the two capitals, the telegraph line between

which already makes use of the route. The third line would involve more difficulties owing to the long section to be constructed on the Spanish side. The convention has not yet been ratified by the two chambers, and the question of cost has also still to be solved.

Migration from Hungary.—A work on 'Migration from Hungary,' by Dr. G. Thirring, Vice-Director of the Communal Statistical Bureau in Budapest, in the *Abrégé du Bulletin de la Société hongroise de Géographie* (1902) shows that, while the history of Hungarian emigration reaches back into the fifteenth century, it has never attained such dimensions as in the last few decades. In the early days it was directed principally towards the neighbouring lands of Austria, Rumania, and Bukovina, in the last of which there are still five Magyar villages. Magyars migrating to Rumania, on the other hand, are always absorbed in a short time into the life of the country. In the two decades from 1881 to 1900, the migration from Hungary has amounted to 380,000 souls, or 2·3 per cent. of the total population. Down to the present day the current of emigration in the eastern counties (Siebenbürgen) has been directed to Rumania; in the southern counties, to Bosnia and Servia; in the western counties, to Austria; and only from the northern counties has it found its way mostly to America. To specify the highest relative and the greatest absolute drainage of population in the different administrative districts, the county of Saros has in the course of these twenty years lost by emigration 26 per cent., or 43,000 of its inhabitants; while the county of Bács-Bodrog (in the south) has lost 75,000, or 15 per cent. In 1857 there were only 53,000 Hungarians dwelling in Austria, whereas in the year 1900 there were more than 270,000, 100,000 of them in Vienna alone. The emigration to America has set in only since the eighteenth century, and in 1841 the Hungarians founded in the State of Wisconsin the colony of Harasztyfalu, which now as Sauk City has long lost all trace of Magyar character. Not till 1877 did the emigration assume large proportions. It was directed especially to Pennsylvania, New York, and New Jersey, and that in consequence of strikes among American workers. The volume of emigration attained its first maximum from 1886 to 1892, and its second in the years subsequent to 1899, since which date Hungarians, by their cheap unskilled labour, have ousted other workers in various departments of industry, as, *e.g.*, in the coalfields of Pennsylvania. The Hungarian ranks, therefore, among the best hated of American immigrants, and the prohibitive measures put in force against objectionable immigration are aimed in part directly at Hungarians.

Recent Research on Glaciation in the Carpathians.—Following the example set in particular by Joseph Partsch, of Breslau, in his investigation of the high Tatra, a series of explorers have in other parts of the Carpathians been examining the traces of the glaciation of the Ice age. First and foremost, Partsch himself has continued his studies, first published in 1882, on glacial traces in the trans-Alpine mountains of Central Europe. In 1901, 1903, and 1904, he extended his examination to the lower Tatra, and the results obtained will probably be published shortly. Meanwhile he has given a first instalment in a paper read to the Silesian section of the Hungaro-Carpathian Union ("Wanderungen und Studien in der niederen Tatra"). He has now restored on a large scale the picture which this, the second highest chain of the upper Hungarian Carpathians (separated from the high Tatra by the broad valley of the upper Waag), must have presented during the Ice age. The glaciation of this chain, running as it does from east to west, was unevenly developed, being confined exclusively to the north side. In this respect it presents an analogy with the essentially one-sided ancient glaciation in the southern Carpathians and the mountains of the Balkan peninsula lying to the north and the north-east. The glaciers proceeded from the cirque-like valleys,

which, in the western part of the chain, lie beneath the three highest peaks of the chain—Jumbir, 6710 feet; Chopek, 6570 feet; and Sblisko, 6410 feet. This last, it may be said in passing, is the correct name for the peak misnamed Chabenec on the military maps. They were mostly valley-glaciers depositing their terminal moraines as far as 3·1 miles from the main ridge, which stood at a height of 2600 to 3300 feet above sea-level. Their traces are distinctly visible in the form of moraine-ridges, valley-steps, and small mountain lakes. In the southern Carpathians the traces of the Ice age have been studied more particularly by De Martonne (1898–1903), Schafarzick (1897), and Ludwig von Lóczy (1903). They were first brought to light in this region by Paul Lehmann, of Stettin, in 1880–1884, but the discovery was for a long time disputed by the Hungarians, though afterwards confirmed by Rumanian geologists. Many more such traces were found by De Martonne, as may be seen in his paper, "La période glaciaire dans les Karpates meridionales" (*Comptes Rendus*, ix. *Congrès géol. internat. de Vienne*, 1903, pp. 691–702). Lóczy, who has published a paper on this subject in the *Proceedings of the Hungarian Geographical Society* (1904), with isohypsometric map of the western part of the southern Carpathians (Retyezát) and isobathometric maps of some of the mountain lakes, counts in the whole of the southern Carpathians ninety such lakes, to which he too ascribes a glacial origin. A comparison of their situation in point of altitude, more especially with that of the "Meeraugen" in the high Tatra, leads him to the conclusion that in the Ice age the outer side of the entire Carpathian arc must have received a larger amount of precipitation than the inner. Cvijić, who, in a recent paper on the Balkan peninsula (*Mitt. Geog. Gesells.*, Wien, 1904), has drawn a parallel between its mountains and the southern Carpathians, finds that the two agree as regards the increasing altitude of the snow-line and the lessening intensity of the glaciation from west to east. In this connection he makes the interesting conjecture that, contrary to the opinion of leading geologists, the main basin of the northern Adriatic must have been occupied by water during the whole of the Ice age. On the other hand, he fits in the different glaciations into the stages of the Alpine Ice age laid down by Penck and Brückner. Both Cvijić in the Balkan peninsula and De Martonne in the southern Carpathians have observed a twofold glaciation, the second and smaller of which was limited to the well-developed cirque-valleys. It is evident that much exploring work still remains to be done in this connection, not only in the Retyezát, but also, probably, in other mountain groups, such as that which lies at the sources of the Theiss, the Howerla group, and others.

ASIA.

Lake Kosso-Gol.—Dr. A. Woeikoff gives, in *Petermanns Mitteilungen* (1904, No. 6), a note on a scientific examination, by S. Peretolchin, of Lake Kosso-Gol, the second in area of the lakes of Eastern Asia which has been the subject of a memoir (in Russian) in the *Trudi* of the Society of Naturalists in the University of Kazan for 1903. The length of the lake, which is six times as large as the Lake of Constance, is 83 miles, the greatest breadth 24½ miles, and the altitude above sea-level about 5470 feet. The western shore is generally steep, but the eastern much more gradual, with many bays. The river Eg, the outlet of the lake, is only some 20 yards wide and 3 feet deep. The maximum depth disclosed by five lines of soundings was 676 feet, but depths reaching 300 feet were found on all the sections, the drop from the shores being comparatively steep, and the greater part of the lake-floor fairly level. The mean depth is estimated at about 500 feet. Observations on the temperature at various depths were taken in August of 1897 and 1899, and July of 1900. In the first-named year a surface temperature of 59°·2

Fahr. was recorded in the northern part; in the second, 54½° in the centre (near Dola-Koi Island); and in the third, one of 46° in the south. At depths of 33 feet (above which in every case the most sudden drop occurred) and over, the differences were comparatively slight (temperature at 33 feet, 44°·6 in 1897, 43° in 1900; at 300 feet, about 38½° in 1899 and 1900). In the cold summer of 1902 the surface temperature was only 41° near Dola-Koi. Koeso-Gol belongs to Forel's type of lakes of temperate latitudes, *i.e.* the temperature in summer is above that of the maximum density, 39°·1 Fahr., in winter below. The lake freezes at the beginning of December, and becomes free from ice in June or July. Both water and ice are very transparent; the thickness of the latter reaches 3–5 feet. The air temperature is low on the shores, daily means above 55° not being recorded until the end of July.

The North-Eastern Passage.—It appears, from a telegram received by the Russian Hydrographical Department from Colonel Drizhenko, that the expedition for the exploration of the route to the mouths of the Ob and the Yenisei has concluded its work by a detailed survey of the western coast of the Yalmal peninsula. It has also described the Byelyi island, which is an important point on the route. The astronomical determinations of Colonel Drizhenko are of special interest, in that they show with what an accuracy the officer Ivanoff, who described the Yalmal coast in the thirties of the last century, made his astronomical determinations. The work of exploration and survey of the route to the mouths of the Ob and Yenisei, which has taken fully eight years, is now completed. It appears that under favourable weather conditions the whole distance from Arkhangelsk can easily be covered in seven days, to which eleven days must be added if the ship starts from St. Petersburg.

The Grand Canal of China.—Father Domin. Gandar, S.J., has published, as *Variétés sinologiques*, No. 4, a reprint of his historical and descriptive study of the Imperial canal. The earliest account of the canal is found in the writings of Confucius. Dug about 485 B.C., the first canal united the Yang-tse Kiang with the Hwai-ho across an interval of over 30 leagues. The history of its successive enlargements and transformations, illustrated by a series of diagrams, is followed through the period of the three kings, in which (24 A.D.) the waters were diverted through the lakes Tsin and Pé ma, and through the dynasties of Tsin, Swei, and Tang, ending under the Song dynasty in 1078. Lasting some 1563 years, the ancient canal attained the length of 435 miles, from Tsing-ho-hien to Hang-Chau. While the ancient canal was fed by the Yang-tse Kiang, flowing from south northwards, the new canal was fed by the Hwai-ho, flowing in an opposite direction—a change in the relief of the soil attributable, in part at least, to the action of the Hwang-ho. The current of events is traced from 1071, when the Yellow river, bursting its banks, changed its direction from north to south to throw itself eastwards into the Chang-ché-lo, down to the year 1289, when new works were begun, and in three years the navigable way from Hang-Chau to the Yellow river was continued to the capital of Kublai Khan. By this continuation of over 600 miles, the Imperial canal reached a total length of more than 400 leagues. Throughout its whole extent it is known as Yun-ho ("canal of transports") and Yun-liang ho ("canal of transport of tribute"). The northern part, to the north of the Blue river, much the busiest and most important, is divided into a south, a central, and a northern section. Two chapters, illustrated by diagrams, are devoted to the exacting labours involved in the maintenance of the canal under the successive dynasties of the Ming and the Tsing. Next follows an account of the state of the canal, 1850–1893; its actual service in the cause of navigation; its facilities and variations in respect of navigability; its bridges, which are purposely reduced to a

minimum; its safety for purposes of navigation, etc. Two maps show the existing canal in two sections. Its total course measures 3630 li, of which 2010 fall to the distance between Tong-Chau and Peking.

Weihaiwei.—A recent colonial report on Weihaiwei gives meteorological returns showing that in 1903 rain fell in this "white man's climate" on seventy-two days, including snow on eighteen days, to the amount of 35·47 inches, a record rainfall for the last five years, exceeding that of 1902 by 6·63 inches. The wettest month, August, yielded 14·18 inches. The highest mean monthly temperature was 81° for August; the actual maximum, 92° in July; the lowest, 17° in January. The rainfall of the last two years shows the bridges on the coast and Chifu roads to be insufficient. The island of Liu Kung is reported to be extremely healthy, being cool in summer, sunny and bracing in winter; the atmosphere dry. In the summer of 1903, the maximum temperature did not exceed 86° Fahr. Among the improvements made in the island in 1903 is the construction of a sea-wall along the shore, and the laying out of the area behind it. On the mainland the main road from Half Moon bay to Flagstaff point, a length of 5 miles, has been metalled, while two new streets have been run through Port Edward. In 1903, 242 steamers of 244,940 tons entered the port, a 66-per-cent. increase over the shipping of 1902. The exports and imports show a proportionate increase, the export of ground nuts increasing from 918 piculs in 1902 to 10,847 in 1903, that of salt fish from 10 to 1392 piculs. The population of the leased territory (285 sq. miles) is about 150,000, including that on Liu Kung island, which is not more than 2000. As regards the resources of the territory, it is pointed out that there are about 85,000 acres planted with scrub oak, a suitable food for the silkworm, which might yield 4000 cocoons per annum. A flourishing fruit trade might also be established by the introduction of the best European varieties of fruits. The suitability of the territory for the growth of vines, field crops, forestry, shade trees, and white wax is also indicated.

AFRICA.

Captain Boyd Alexander in Nigeria.—Writing from Lokoja on July 28 of this year, Captain Boyd Alexander gave a short summary of the proceedings of his expedition for survey and zoological work in Nigeria (*Journal*, vol. xxiii. p. 255) down to that date. Some unforeseen difficulties and delays had occurred, arising principally from the illness of one or two members of his party; but these had recovered at the time of writing, and it was hoped that a renewed start for the first main objective of the expedition—Bornu—would shortly be made. Reaching Lokoja on March 24, the expedition at once prepared for the journey up the Benue to Ibi, which had been fixed upon as the first base. The two steel boats were put together, and a start was made on March 31 with these and five large canoes. The average depth of the Benue was then 3 feet, and there were many sandbanks, but the steel boats proved very satisfactory, the Hodgett principle adopted (that of having a curved-in bottom)* giving stability and buoyancy, and at the same time causing less resistance to the current, which ran in places at the rate of 6 miles an hour. The arrival at Ibi took place at the worst season (April—May) as regards health, though the best for survey and geological work, as the grass is still short and the air is not clouded by bush fires. From Ibi (where five clear nights favoured the astronomical observations) it was decided first to triangulate as far as Bauchi with a view to connecting this place with subsequent work in

* The same principle was adopted with success, it will be remembered, for the steam-launch taken up the Zambezi by Major Gibbons.

Bornu. By a fortunate chance, some good sights were obtained on to the Murchison range, which came out clear and distinct one afternoon after heavy rain. By this means 60 miles of heavy bush country was bridged over, the points in the range being subsequently picked up during the triangulation. This was the work of Lieut. Claude Alexander and Mr. Talbot, but it was hampered, first by the illness of Mr. Talbot, afterwards by the famine then prevailing in the country; but good progress was eventually made, and the latest accounts stated that only one more station remained to be occupied before Bauchi should be reached. A good occultation was taken at Wase by Mr. Talbot, and the bearings of distant points in the hill country obtained from the remarkable rock at that place. Meanwhile, zoological work was done by the leader and Captain Gosling at Ibi, and a fine collection was obtained by the Portuguese assistant from the hills about Tarkum to the south. This man met with many of the Munchi people—an industrious race whose well-kept farms offer a great contrast to the slipshod methods of their northern neighbours, though they have hitherto shown themselves adverse to the coming of the white man. Like their neighbours, the Egbaras and Bassas, they are typical Bantus, and they show a remarkable resemblance, in dress, manners, and customs, to the Bubis of Fernando Po. Preparations were now made for the departure of the river column up the Gongola (or Gombe, as it is called by the natives), and the two boats, with a flotilla of canoes, left for this river on June 30, being probably the first transport boats to make its ascent. Ashaka, on its upper course (in 10° 26′ N., 11° 7′ E.) has been chosen as the next base. It lies centrally between the large towns of Kupto, Burmi, and Naffata, whence the necessary supplies can be drawn. The survey column was to move overland to Ashaka, whence it was proposed to take the bulk of the expedition across to the Komadugu, and descend this to Yo and Lake Chad, another column with supplies going by road to Kuka. Captain Alexander had meanwhile run down to Lokoja, but hoped to leave for Bauchi in a few days by the Loko-Keffi route, hoping to obtain some interesting zoological data *en route*, as the hills above Keffi may possibly be found to influence distribution.

A Characteristic Form of Surface in Africa.—All who have read the accounts of African travellers, descriptive of the surface features of the continent, must have been struck with the frequency of recurrence of a type of surface in which a generally level plain is broken here and there by isolated elevations (usually composed of granite or other ancient crystalline rocks), rising like islands above the general level of the country. For certain special regions attempts have been made (*e.g.* that of Dr. Dantz, in regard to German East Africa, referred to in vol. xx. p. 231 of the *Journal*) to explain the mode of origin of this form of surface; but few writers (if any) have taken a general survey of the whole continent from this point of view. This is now done by Dr. S. Passarge in the *Naturwissenschaftliche Wochenschrift* for July 17 last, in a paper which, though its conclusions are largely based on hypothesis, is suggestive and valuable as showing the importance of a further study of the question. After mentioning the various possible ways in which such a form of surface, which is found principally in the Sudan, East and South Africa, might originate * (by tectonic, marine, volcanic, or erosional agencies), Dr. Passarge deals in turn with different areas, each of which he considers to display a special type of the feature in question. Beginning with Bechuanaland, where he has himself studied it with special care, he finds the present surface can only be explained as a result of erosion—the mountain being outstanding masses

* As a general term for this type of landscape, Dr. Passarge uses the clearly descriptive if somewhat cumbrous expression "Inselsberglandschaft."

of rock left by the action of denudation—and that this erosion can have been none other than wind-erosion acting under more or less desert conditions. Coming next to Adamawa (also known to him from personal observation), he finds a type which, though differing from that of Bechuanaland, can, he thinks, be explained as having originated in the same way, though subsequently modified by river erosion. In Kordofan, the original framework of which was considered by Dr. Linck (the latest scientific traveller to visit the country) to have been a mountain land seamed by deep valleys, Dr. Passarge likewise sees evidences of an old surface of wind-erosion, pointing to the survey under Prout in the seventies of last century as showing that the granitic detritus now spread over the surface overlies a stratum of mica-schist, which occurs at a remarkably even depth below the surface. He thus considers that the old plain of æolian denudation has been since covered over by detritus, obtained from the wearing down of the mountains. In regard both to Kordofan and the large areas of the Sudan composed of non-fossiliferous sandstone, he negatives the idea that the existing surface formations are the result of marine denudation, holding that they are the counterpart of the *lower* portion of the Nubian Sandstone, which has been thought to be of continental origin, and which was formed in Mesozoic times, before the Cenomanian influx of the sea in these regions. It will be seen that Dr. Passarge is perhaps too much inclined to reduce all the types to one original mode of formation, so that the suggested conclusion, that much of equatorial Africa was subject to desert conditions in Mesozoic times, rests at present, as he himself allows, on anything but a sure foundation. But the interest attaching to a further investigation of this form of surface in its bearing in the past history of Africa and the Earth as a whole, is clearly brought out by the paper.

AMERICA.

Buried Ice-sheets in the Tundra of North America.—In the third number of the *Journal of Geology* for the present year, Mr. J. B. Tyrrell explains the formation and growth of buried ice-sheets examined by him in the Yukon territory. Between the glaciated coast and the Rocky Mountain ranges is a country of high hills and deep valleys. In the bottoms of these valleys flow streams flanked on one or both sides by alluvial deposits, from 10 to 100 feet in depth, consisting below of coarse sand and gravel; above this, of fine sands with peaty and vegetable matter; and, as topmost layer, of "muck" or sphagnum swamps. The surface of this region, whether formed of "muck," gravel, or rock in place, is almost everywhere permanently frozen. Here and there, however, are unfrozen channels through which issue springs from the sides of the hills, carrying water from the unfrozen depths to the surface. Some of these springs lie beneath the ordinary surface level. Let the flow from the spring be not large, and the ground be covered with a coherent mass of sphagnum bog, then the spring water, already at 32° Fahr., rises till, within the influence of the atmosphere above, it freezes. With the increasing cold of winter the ice continues to form downward. At length, a few feet below the surface, but still within the influence of the low external temperature, a plane of weakness, generally determined by a thin horizontal band of silt or fine sand, is reached in the frozen vegetable deposit. All outlet to the top being now permanently blocked, the water is forced along this plane, and there freezes. Increasing in extent, it increases also in thickness, until its bottom plane is beyond the reach of the low atmospheric temperature above. Thereafter it continues to increase in extent, but not in depth. With the advent of warm weather the growth of the ice-sheet ceases, but the cold spring water continuing to rise up beneath it has little power to melt it, and its "muck" covering, being an excellent non-conductor of heat, protects it from sun and wind, and prevents it

from thawing. Such sheets of clear ice, more or less horizontal, attain a thickness of from 6 inches to 3 feet or more. In area they differ greatly. One observed by Mr. Tyrrell on the shore of Lake Daly, west of Hudson Bay, might underlie a square mile or more. Many in the bottom lands of the gold-bearing Klondyke creeks vary in length from 100 to 1000 feet, and in width from 50 to 200 feet.

A Journey round Mount McKinley.—The American polar traveller, Dr. F. A. Cook, describes in the *Bulletin* of the American Geographical Society (1904, No. 6) an expedition to Mount McKinley, the highest summit of North America, carried out by him in 1903, with a small party from New York and Seattle. Dr. Cook had set before him as an object of his ambition the ascent of the great mountain, but though this was not accomplished, a height of 11,400 feet was reached and the entire circuit of the mountain made, so that our knowledge of the features of the Alaskan range in which it stands has received some welcome additions. Landing at Tyonek, on Cook inlet, on June 23, the explorers started with fourteen pack-horses for a tramp of 500 miles to the west side of the range, which was chosen as the most promising for the first attempt. For thirty days they suffered from cold rains, and men and horses were tormented by mosquitoes; but on the far side of the range these disappeared, the weather improved, and game was everywhere abundant. On August 14 a base camp was pitched 14 miles north-west of the great mountain, which on this side showed, above 12,000 feet, an almost uninterrupted cliff of pink granite, with ridges running out to the north-east and south-west. The latter ridge seemed to give a possible route to the summit, and two attempts were made to ascend by it, but on both occasions insurmountable obstacles barred the way. The second attempt was made over the surface of the Peters glacier, which descends on this side, but the travellers were brought up at the foot of a nearly vertical granite wall of 4000 feet. It was too late to make an attempt from the north or east, but Dr. Cook and his companions made a circuit to the north-east, crossed the range, and then skirted its eastern face, returning to the coast by the Sushitna river. Mount McKinley is said to stand out as a giant peak from whatever side it is viewed. From the west it rises out of a great extent of low grassy country, while it is continued on both sides as a range 10,000 feet high—sharp, narrow, and crested with icy cornices. In its general appearance the mountain is likened to the crown of a molar tooth. Besides the great Peters glacier, which sweeps the whole western face, there are two vast glaciers on the east and south-east, one of which, Fidele glacier, is thought by Dr. Cook to be the largest of interior Alaska.

AUSTRALASIA AND PACIFIC ISLANDS.

Bellenden-Ker Range, Queensland.—A Queensland official report by Mr. A. Meston on an expedition carried out this year to Bellenden-Ker range, throws new light on its geography and flora and fauna. Starting in the north, near Behana creek, 20 miles south of Cairns, the range rises gradually into a ridge 1700 feet high. Thence dipping 300 feet in a saddle, it again rises to 2400 feet in Mount Toressa, the first peak in the range. Thence, after another dip of 600 feet, it rises in Mount Sophia to 4060 feet. Again descending 1000 feet, it then rises abruptly in the North peak to 5000 feet. Beyond this North peak, the range, gradually curving south-west and westwards, sends up four more peaks, ending in the southern and highest peak at 5200 feet. In its further course the range broadens out, and in this direction a spur connects it with the Bartle Frere range, dividing the waters flowing south into the Russell from those flowing north into the Mulgrave. The total length is about 18 miles. Clothed from apex to base in luxuriant jungle, the western slopes descend some 3000 feet in the first 3 miles, and 1200 feet in the

next 3. The eastern slopes are also steep, but the vegetation is relatively poor. The yearly rainfall is about 200 inches. The whole range is composed of granite, traversed everywhere by quartz reefs and veins. Dense luxuriant scrub covers the whole area, the soil of which is composed entirely of decomposed vegetation. The steep spurs and deep ravines are covered by gigantic vegetation, and it is in the dark ravines of the western side, where no sunlight enters before 9 and 10 a.m., that the vegetation is rankest. Enormous trees grow from the base up to 4500 feet. On the south spur alone there is an incalculable quantity of splendid timber, a remarkable fact being its intense hardness, saplings of 6 inches diameter being as hard as iron bark in South Queensland. Starting as low as 2600 feet, the mangosteen tree showed no signs of fruit till at 4000 feet, but thence as far up as 4700 feet the trees were nearly all fruiting. As the result of his expeditions of 1889 and 1904, Mr. Weston concludes that Queensland possesses the most interesting flora and the most numerous and valuable wild fruits in the world. From his last expedition he brought down nearly a hundred kinds of fruits, not one of which is known outside the Bellenden-Ker range. Of these thirty-five are edible in their present wild state.

POLAR REGIONS.

Fossil Flora of the Antarctic: Erratum.—We regret that in the note on this subject in the August number of the *Journal* (p. 200), Dr. Nathorst's name was, by a slip of the pen, replaced in the latter part of the note by that of Dr. Andersson, who had been alluded to previously as the discoverer of fossil remains of plants in the Antarctic. As stated at the beginning of the note, the discussion of the questions involved by this discovery is from the pen of Dr. Nathorst, by whom the identifications alluded to in the latter part of the note were made, and whose name should therefore be read throughout this part in place of that of Dr. Andersson.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Proposed Indian Ocean Expedition.—As mentioned in our report of the Cambridge meeting of the British Association, an important expedition is shortly to be despatched by the Admiralty for the scientific examination of the Indian ocean on the lines followed by the *Challenger* Expedition in regard to the other great oceans. For want of such a detailed study in the case of the Indian ocean, our knowledge of the configuration of its floor, of the conditions of temperature and salinity of its waters, and of the distribution of life within it, is at present extremely defective, and all interested in such questions will learn with satisfaction that they are now likely to receive elucidation as a result of the proposed expedition. H.M.S. *Sealark* has been detailed for the purpose, and will, it is hoped, leave Ceylon in April, 1905, to commence operations. Permission has been given for two naturalists to accompany her, the first of whom, Mr. J. Stanley Gardiner (Fellow of Gonville and Caius College, Cambridge), is already well known to geographers for his researches in marine biology and allied subjects in the Pacific, and among the Maldive and Laccadive archipelagoes, extending in all over nine years. The second naturalist, Mr. Forster Cooper (also of Caius College), has spent nearly a year in the Maldives and in Ceylon. The programme laid down for the expedition is as follows. The *Sealark* will proceed first to the Chagos archipelago, where three months will be spent in sounding, dredging, etc. A line of soundings will then be run down to the Seychelles-Mauritius line, and an additional three months will be spent in thoroughly examining the submerged banks on that line, the Nazareth and Saya de Malha. Agalegas islands will then

be visited, and the expedition will end at the Seychelles. The work of the expedition will be of special interest in view of the former land connection which almost certainly existed between India, Madagascar, and South Africa. In addition to the soundings, temperature and salinity observations will be made throughout, and samples of the bottom deposits taken. A special feature will be the examination of the general conditions of the intermediate depths, from 50 to 500 fathoms, with particular reference to their fauna and flora, and the formation of coral and other banks. Attention will also be paid to the distribution of littoral animals, both vertically and horizontally, as well as that of the pelagic fauna, this last with special reference to the larvæ of littoral forms.

Methods of determining Coastal Development.—Mensuration methods of determining geographical distinctions give useful results, provided they are obtained by legitimate processes, and are used with discrimination as a contribution to, and not as a complete solution of, geographical problems. The question of expressing coastal development numerically is an old one. Karl Ritter, regarding the coast as an indication of the penetrability of the land, expressed the coastal development in terms of the area of the land. The numerical expression used was in the ratio of the actual length of shore-line to the minimum possible perimeter, *i.e.* the length of the circumference of a circle enclosing the area in question. A second method is to compare the length of the actual shore-line with that obtained by joining the innermost or the outermost points by straight lines or by double tangents. A third method, recently employed by F. Schwind ("Die Riasküsten und ihr Verhältnis zu den Fjordküsten unter besonderer Berücksichtigung der horizontal Gliederung," Liepzig Dissertation, 1901), compares the length of the shore-line with that of a selected isobath, which has a much smoother course. A fourth method is to compare the areas of two surfaces, *e.g.* that of the mainland limited by a selected contour with that of the peninsulas and islands lying outside this contour, or the ratio of the areas between the equidistant lines landward and seaward of the shore-line. Prof. de Martonne has criticized these methods ("Le développement des côtes bretonnes et leur étude morphologique," *Travaux scientifiques de l'Université de Rennes*, vol. ii. part iii., 1903), and summarizes the desiderata for the numerical expression of coastal development as follows: (*a*) The results should give corresponding value for homologous coasts; (*b*) the values should be capable of arrangement in a series corresponding to the sequence of the phenomena determining the forms of the coast which they represent; (*c*) vertical as well as horizontal dimensions should be taken into account. He agrees with Ratzel ("Studien über Küstensaum," *Bericht. K. Sächs. Gesels. der Wissenschaft, Leipzig, phil.-hist. Klasse*, August 1, 1903, p. 205) that linear comparisons should be between the shore-line and a real contour-line, but he points out that the ratios for the great lobed coasts, *e.g.* anses of Britanny, will be almost indistinguishable from those for the alluvial (marsh) type. He suggests that a comparison of lengths with areas is the best, and that the area of such a belt as that between the contour-lines of +10 and −10, or +20 and −20 metres will yield the most fruitful results.

The Energy developed by Earthquakes.—Dr. R. von Kövesligethy, of Budapest, is responsible for an ingenious calculation of the work done by great earthquakes. Starting from the coincidence between periods of rapid displacement of the positions of the poles and of frequency of large earthquakes, and assuming that this is not a mere coincidence, but a relationship between the two, he finds that the irregularities in the movement of the poles represent an amount of work equal to the raising of a mass, equal to that of the Earth, through 1·2 millimetre at its surface by each of the 200 world-shaking earthquakes registered during the eight years 1895–1902 (*Die Erdbebenwarte*, iii. (1904), pp.

196–200). We may carry this calculation a little further, and find that the work done spasmodically by these earthquakes represents seventy-five billion (75,000,000,000,000) horse-power working continually, night and day.

The Age of Glacier-Ice.—In the 7th number of the *Geographische Zeitschrift* for the present year, Dr. Hans Reusch raises the question of the age to which glacier-ice may possibly attain in exceptionally well-sheltered spots, basing his remarks on a recent examination of a small Norwegian glacier (the Riings glacier) which presents some rather special features. Among these are the comparatively large area covered by the ice-stream in proportion to the small gathering-ground of the *névé*; the existence in the lower part of the glacier of a raised ridge, running parallel to its length; the extraordinary coarseness of the ice-grains, and the clearness of the stream which issues at the lower end, showing that erosion is practically at a standstill. The writer thinks that the glacier may be considered at present in a half "dead" condition, and from indications which he saw of the small annual amount of movement, even at the surface, he suggests that some of the existing ice may date back as far as to the Neolithic age. It cannot be said that his reasoning is entirely convincing, and a possible fallacy seems to consist in the idea that the rate of movement since Neolithic times must always have been as slow as at present.

GENERAL.

The Olive.—Following on his monograph, published a quarter of a century ago, on the date palm, Prof. Dr. T. Fischer has now, as a supplementary number to *Petermanns Mitteilungen*, published a monograph marked by like comprehensive scope, and like human interest, on the olive. The fruit of thirty years' personal observation and scientific study, this treatise is the most complete existing account of the olive in its history, distribution, and economic and cultural aspects. As is well known, the olive has from earliest times served the Mediterranean population in the way of food, religious rites, lamp oil, ointment for the hair and body, and as an article of export. Second neither to wheat nor the vine in respect of geographical range, range of time in human history, or of material and moral import, the olive is inseparably bound up with human culture, flourishing also in Mediterranean vocabularies and literatures—in Homer, Pindar, Æschylus, and the books of the Bible, etc. It figures prominently also in geographies, histories, and travellers' tales, from ancient times. A few figures may be quoted: Olive trees in Italy number 100 millions, and in Spain 300 millions. These figures will be better appreciated in comparison with the fact that in all Germany there are only 164 million fruit trees. Tunisia, in spite of its now being in vast part desert, possesses 20 million olives. In Corsica there are 36 millions. In California there were, in 1894, 425,000 olive-bearing and 1,360,000 young olive trees. In 1895, 800,000 young plants were transplanted. In Australia, in the eighties of last century, there were 53,776 olive trees, yielding 1411 gallons of oil. As a geographer, Prof. Fischer inclines to the view, which seems to have also the preponderance of botanical opinion in its favour, that the oleaster is not the olive tree grown wild. The oleaster ranges from the eastern border of Persia to the furthest south-west of Morocco, and reaches, though apparently only exceptionally, to the north of 40° N. The olive, on the other hand, is a strictly Mediterranean plant, ranging from Syria on the east westwards over all the Mediterranean lands, whence it has been transplanted to certain lands in North and South America, South Africa,* and Australia,

* The author's remarks on what would have been done by the British in South Africa, in the hypothetical case of the Boers possessing olive orchards, seems somewhat uncalled for and out of place in a scientific treatise.

rejoicing, like the Mediterranean, in a climate favourable to its culture. Prof. Fischer is confirmed in the view that the polar and altitudinal frontier of the olive coincides with that of the Mediterranean flora. The instructive map at the end, embodying almost exclusively the results of the author's personal investigations, would thus present a picture of the geographical range and distribution, not of the olive alone, but also of the most important representatives of the Mediterranean flora.

OBITUARY.

Mrs. Bishop.

The distinguished traveller, Mrs. Isabella Bishop, died at Edinburgh on October 7, after a fourteen months' illness, at the age of seventy-two years. Always more or less of an invalid, Mrs. Bishop accomplished an amount of work in out-of-the-way parts of the world which would have been no mean achievement even for the most robust, and for the extent and value of the information she brought home from her wanderings she may be ranked with the most accomplished travellers of her time, while among the many distinguished lady travellers who have come before the public during the past half-century, her title to the foremost place can hardly be challenged.

Mrs. Bishop was the eldest daughter of the Rev. Edward Bird, Rector of Tattenhall, Cheshire, her mother belonging to the Lawson family of Boroughbridge, Yorkshire. From her early years she suffered from ill health, and on this account remained more constantly in the society of her parents and the intellectual circle in which they moved than might otherwise have been the case, making long carriage expeditions with them, and thus acquiring an unusually intimate knowledge of many parts of Great Britain. After a short incumbency of St. Thomas's, Birmingham, her father, whose health had at this time given way, moved to the small country village of Wyton, in Huntingdonshire, and here at the age of sixteen Miss Bird made her first essay at authorship in the form of a pamphlet, published by a Huntingdon bookseller, dealing with the rival claims of free trade and protection, the latter of which she favoured. From this time she contributed more or less regularly to various periodicals, and a few years later, at the age of twenty-four, the first of her many books of travel appeared under the title 'An Englishwoman in America.' It was the outcome of a journey to Prince Edward island, undertaken two years previously under medical advice, and consisted of pleasantly written descriptions of her experiences, indited in the first instance for the benefit of her friends at home. This was also the beginning of her long association as an author with the publishing house of Mr. Murray, which was maintained to the end of her literary career.

Unlikely as it might seem at first sight, it was her continued ill health which was really responsible for the extent and variety of her travels, for notwithstanding the fatigues and positive hardships which they frequently—especially the later of them—involved, she seemed able only to obtain relief when in constant movement, no doubt through the bracing effect of change of scene, and the alertness of all the faculties called out by her venturesome enterprises. Her next two books, published in 1873 and 1874, described her experiences in the Sandwich islands and in the Rocky mountains, in both of which she had spent some time during prolonged journeys, which extended also to Australia and New Zealand. Her more

serious travels, all of them more or less connected with the East, began a few years later with a visit to Japan, where she penetrated into districts hardly, if at all, known to the European world, and on which she shed a valuable light from the intimate way in which she mixed with the people, and the keen powers of observation which she brought to bear on all she saw. Her volumes, published in 1880, under the title "Unbeaten tracks in Japan," described extensive routes in the main island, which she crossed from the capital to Niigata, afterwards traversing much of the wild northern interior and making her way to the shores of the Tsugaru strait. Crossing over to Yezo, she penetrated to the interior settlements of the Hairy Ainos, of whose characteristics and peculiarities she was thus able to present a vivid picture. In this and in all her subsequent journeys, she chose for the scene of her studies countries which were coming into public notice, and her narratives, which embodied the results of much careful inquiry, and showed considerable power of insight into the political, moral, and religious conditions of the populations among which she moved, were thus of distinct practical interest at the time of their appearance.

In 1881 Miss Bird married Dr. John Bishop, of Edinburgh, and during the few years of her married life, spent for the most part in that city, her geographical activity was temporarily in abeyance, though she published in 1883 the volume entitled 'The Golden Chersonese and the Way thither,' describing her visits to Southern China and the Malay peninsula. She had previously brought out, anonymously, a pamphlet describing in a realistic way, under the title 'Notes on Old Edinburgh,' the conditions of life in some of the slums of that city. Becoming a widow in 1886, she resumed her Eastern travels, this time turning her attention to the nearer countries of Persia and Asiatic Turkey. The journeys she made in these countries were perhaps the most adventurous of all her many wanderings, and much hardship was involved owing to the great cold and the difficult mountain regions through which much of the way led. The most remarkable journey was that made in 1890 through the Bakhtiari country and Luristan to Lakes Urmi and Van, in which to the physical dangers encountered were added those arising from the wild and turbulent inhabitants. The narrative of these journeys appeared in two volumes in 1891. Shortly afterwards she published a short account of journeys in Kashmir and Ladak carried out in 1889.

Between 1894 and 1897 Mrs. Bishop paid four different visits to Korea, on one of which she ascended both branches of the Han river, crossed the Diamond mountains with their Buddhist monasteries, and reached Wensan on the east coast. In her two volumes, 'Korea and her Neighbours,' published in 1898, she supplied much information on the internal conditions of Korea, giving also an account of the state of affairs in Manchuria, which she had visited in 1894. Her next work, 'The Yangtze Valley and Beyond' (1899), described a boat journey up the Yangtse and a land route through Sechuan to the district of the aboriginal Miao-tze tribes, into which she penetrated further than any of her predecessors. On one occasion during this journey she was in some danger at the hands of an infuriated Chinese mob. The book was profusely illustrated from her own photographs. Mrs. Bishop's last foreign adventure consisted in a journey in Morocco in 1901, during which she visited the Atlas mountains, but of this she published no detailed account. In 1903, her health becoming worse, she retired to a nursing institution in Edinburgh, and though she subsequently rallied somewhat, she was unable to regain her strength, becoming gradually weaker until the end came.

Mrs. Bishop was keenly interested in missions, though a candid critic where criticism seemed called for. Medical missions especially evoked her sympathy, which took a tangible form in the erection, at her own expense, of various hospitals

in the East. She herself ministered to some extent to the medical needs of the peoples among whom she travelled, and to these services, and to the sympathy she always showed in her dealings with the less civilized races, must be ascribed much of her success. While her principal interest always centred in the peoples she met with, she was also keenly impressed by natural scenery, of which her works contain many vivid descriptions. She became a Fellow of the R.G.S. in 1892, being among the twenty-two ladies admitted to membership in that year.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic Sea—Tide. *M.K. u. K. Militärg. I.* **23** (1903): 81–132. **Sterneck.**
Die Höhe des Mittelwassers bei Ragusa und die Ebbe und Flut im adriatischen Meere. Von Dr. R. v. Sterneck. *With Map and Diagram.*

Albania. *M.K.K.G. Ges. Wien* **47** (1904): 2–10. **Ippen.**
Ueber die geographischen Namen in Albanien. Von T. A. Ippen.

Alps. *Jahrb. Schweiz. Alpenclub* **39** (1903–1904): 298–314. **Forel, Lugeon, and Muret.**
Les variations périodiques des glaciers des Alpes suisses. Par Dr. F. A. Forel, Dr. M. Lugeon, E. Muret. Vingt-quatrième rapport. 1903.

Alps. *M. Deutsch. u. Österreich. Alpenv.* (1904): 157–159. **Schmolz.**
Die Bestimmung der Baum- und Krummholzgrenzen in den Ostalpen. Vorläufige Mitteilung von K. Schmolz.

Alps—Crystal-seekers. **Königsberger.**
Jahrb. Schweiz. Alpenclub **39** (1903–1904): 262–297.
Das Strahlen und die Strahler. Von Dr. J. Königsberger. *With Map and Illustrations.*

Alps—Historical. **Meyer von Knonau.**

Jahrb. Schweiz. Alpenclub **39** (1903-1904): 196-211.

Die Bedeutung der Alpen um den Gardasee für den Kampf Bonapartes um Mantua 1796 und 1797. Von G. Meyer von Knonau.

Austria. *G.Z.* **10** (1904): 332-343. **Frech.**

Bau und Bild Österreichs. III. Die Karpathen. IV. Die Ebenen Osterreichs. Von Prof. Dr. F. Frech. *With Sketch-map and Plate.*

Austria-Hungary. **Peucker.**

Kleines Orts-Lexikon von Österreich-Ungarn enthaltend alle Ortschaften und Gemeinden von mehr als 2000 Einwohnern, etc. Neu zusammengestellt von Dr. K. Peucker. 3 Ausgabe. Wien: Artaria & Co., 1904. Size 7 × 5, pp. x. and 146. *Presented by the Publishers.*

This little work will be useful for purposes of reference, although the information given is limited to simple statistical details. The results of the last census are embodied.

Austria-Hungary—Galicia. *Ymer* **24** (1904): 157-179. **Heimer**

Petroleum- och jordvaxförekomsterna i östra Galizien. Af A. Heimer. *With Map and Illustrations.*

Belgium. **Cornet.**

Études sur l'Évolution des Rivières belges. Par J. Cornet (Extrait des *Annales de la Société géologique de Belgique*, t. xxxi., *Memoires.*) Liège: Imp. H. Vaillant-Carmanne, 1904. Size 10 × 6½, pp. 242. *Presented by the Author.*

This will be specially noticed.

Dardanelles. *Quarterly J. Geolog. S* **60** (1904): 243-295. **English.**

Eocene and Later Formations surrounding the Dardanelles. By Lieut.-Col. T. English. *With Map and Plates.*

Europe—Anthropology. *C. Rd.* **138** (1904): 1533-1534. **Pittard.**

De la survivance d'un type négroïde dans les populations modernes de l'Europe. Note de E. Pittard.

Europe—Cartography. **Stavenhagen.**

Petermanns M. Ergänzungsheft. Nr. **148** (1904): pp. xxviii. and 376.

Skizze der Entwickelung und des Standes des Kartenwesens des ausserdeutschen Europa. Von W. Stavenhagen.

France—Paris. **Baedeker.**

Paris and Environs, with Routes from London to Paris. Handbook for Travellers by Karl Baedeker. Fifteenth Edition. Leipzig: K. Baedeker, 1904. Size 6½ × 4½, pp. liv., 458, and 28. *Maps and Plans. Price* 6*m. Presented by the Publisher.*

Russia—Lapland. **Pearson.**

Three Summers among the Birds of Russian Lapland. By Henry J. Pearson. With History of Saint Triphon's Monastery and Appendices. London: R. H. Porter, 1904. Size 9½ × 7, pp. xvi. and 216. *Map and Illustrations. Price* 20*s. net. Presented by the Publisher.* [To be reviewed.]

United Kingdom—Mersey. **Nares.**

Report on the Present State of the Navigation of the River Mersey (1903), to the Right Honourable the Commissioners for the Conservancy of the River Mersey. By Vice-Admiral Sir G. S. Nares, K.C.B., F.R.S. London: Printed by Darling & Son, 1904. Size 10 × 6½, pp. 20. *Presented by the Author.*

United Kingdom—Meteorology.

Meteorological Grant Committee. Report of the Committee appointed to inquire into the administration, by the Meteorological Council, of the existing Parliamentary Grant. Vol. i. Report; vol. ii. Evidence and Appendices. London: Eyre & Spottiswoode, 1904. Size 13 × 8½, pp. (vol. i.) 20; (vol. ii.) 122. *Price* (vol. i.) 2½*d.*; (vol. ii.) 1*s.*

United Kingdom—Yorkshire. **[Murray.]**

[Murray's] Handbook for Yorkshire. Fourth Edition. London: E. Stanford, 1904. Size 7 × 5, pp. viii., 66, and 594. *Maps and Plans. Price* 14*s. Presented by the Publisher.*

This edition has been considerably extended and revised throughout, improvements and additions being also made to the maps.

ASIA.

Central Asia. **Hedin.**

Sven Hedin. Scientific Results of a Journey in Central Asia, 1899–1902. Vol. i. The Tarim River, by Dr. Sven Hedin. Vol. vi., Part i., Zoologie, von Prof. Dr. W. Leche. Maps, 1. Stockholm: [P. A. Norstedt & Söner, 1904.] Size 13 × 10; Maps 16 × 12; pp. (vol. i.) 524; (vol. vi. part i.) 70. *Illustrations. Presented by Dr. Sven Hedin.* [To be reviewed.]

China. **Ular.**

A Russo-Chinese Empire. An English Version of "Un Empire Russo-Chinois." By Alexandre Ular. London: A Constable & Co., 1904. Size 8½ × 5½, pp. xx. and 336. *Price 7s. 6d. Presented by the Publishers.*

A remarkable book, presenting much food for reflection in regard to the future of China in its relations with the West, though at the same time containing much that is not likely to be accepted without controversy.

China—Manchuria. **Weale.**

Manchu and Muscovite. By B. L. Putnam Weale. Being Letters from Manchuria written during the Autumn of 1903. With an Historical Sketch entitled "Prologue to the Crisis," giving a Complete Account of the Manchurian Frontiers from the Earliest Days, and the Growth and Final Meeting of the Russian and Chinese Empires in the Amur Regions. London: Macmillan & Co., 1904. Size 9 × 6, pp. and 552. *Maps and Illustrations. Price 10s. net. Presented by the Publishers.*

Gives a very full and up-to-date account of the history of Manchuria down to the eve of the present war.

Philippine Islands—Bibliography. **Tavera.**

Biblioteca Filipina ó sea catálogo razonado de todos los impresos, tanto insulares como extranjeros, relativos a la historia, la ethnografia, la lingüistica, la botánica, la fauna, la flora, la geologia, la hidrografia, la geografia, la legislación, etc., de las Islas Filipinas, de Joló y Marianas. Por T. H. Pardo de Tavera. Washington, 1903. Size 11 × 7½, pp. 410. *Presented by the Library of Congress.*

Russia—Caucasus. *Materialien Geologie Russlands* **21** (1904): 255–381. **Andrusov.**

N. Andrusow. Geologische Untersuchungen auf der Halbinsel Taman. [In Russian.] *With Map and Plates.*

Russia—Caucasus. *Alpine J.* **22** (1904): 132–136. **Baddeley.**

Some remarks on the Nomenclature of Ossetia and adjacent countries, with special reference to Dr. Merzbacher's map. By J. F. Baddeley.

Russia—Caucasus. *Materialien Geologie Russlands* **21** (1904): 199–254. **Pjatnizky.**

P. Pjatnizky. Geologische Untersuchungen im Centralkaukasus. I. Zwischen dem Elbrus und der ossetinischen Militärstrasse. Vorläufige Mittheilung. [In Russian.] *With Plates.*

Russia—Siberia. *Naturw. Wochenschrift* **3** (1904): 577–583. **Pohle.**

Das Mammut in der Vergangenheit Sibiriens. Von Dr. R. Pohle.

Russia—Siberia. **Swayne.**

Through the Highlands of Siberia. By Major H. G. C. Swayne. London: Rowland Ward, 1904. Size 9 × 6, pp. xiv. and 260. *Map and Illustrations. Price 12s. 6d net.*

An account of a trip mainly for purposes of sport, but of interest from the picture which it presents of a part of the world not too well known to English readers.

Russia—Siberia—Altai. *Globus* **85** (1904): 313–318. **Brecht-Bergen.**

Der Altai und sein Gold. Von R. Brecht-Bergen. *With Map and Illustrations.*

Siam. *J. Asiatique* **1** (1903): 185–239. **Aymonier.**

Le Siam Ancien. Par É. Aymonier.

South-Eastern Asia. **Clifford.**

Further India; being the story of exploration from the earliest times in Burma, Malaya, Siam, and Indo-China. By Hugh Clifford, C.M.G. London: Lawrence & Bullen, 1904. Size 9 × 6, pp. xii. and 378. *Maps and Illustrations. Price 7s. 6d. Presented by the Publishers.* [To be reviewed.]

Turkestan. *B. American G.S.* **36** (1904): 217–228. **Davis.**

A Summer in Turkestan. By W. M. Davis. *With Illustrations.*

See note in the August number.

Turkey. **Sykes.**

Dar-ul-Islam. A record of a journey through ten of the Asiatic provinces of Turkey. By Mark Sykes. With Appendix by J. H. Smith, and Introduction by Prof. E. G. Browne. London: Bickers & Son, 1904. Size 9½ × 7, pp. xxiv. and 294. *Maps and Illustrations. Price* 15*s.*

Contains the result of much careful observation on the present condition of affairs in Asiatic Turkey.

Turkey—Asia Minor. *Alpine J.* **22** (1904): 124–129. **Baker.**

The Mysian Olympus. By G. P. Baker. *With Illustration.*

Turkey—Asia Minor. *Z. Ges. Erdk. Berlin* (1904): 257–273. **Philippson.**

Das westliche Klein-Asien auf Grund eigener Reisen. Von Prof. Dr. A. Philippson. *With Illustrations.*

AFRICA.

Africa. *Naturw. Wochenschrift* **3** (1904): 657–665. **Passarge.**

Die Inselsberglandschaften im tropischen Afrika. Von Dr. S. Passarge. *With Illustrations.*

See note in Monthly Record (*ante*, p. 590).

Africa—British Protectorates. ———

Africa. No. 10 (1904). Memorandum on the state of the African Protectorates Administered under the Foreign Office. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. 10. *Price* 1½*d.*

British East Africa. *Nineteenth Century* **56** (1904): 370–385. **Eliot.**

The East Africa Protectorate as a European Colony. By Sir C. Eliot, K.C.M.G.

British East Africa. *J. African S.* **3** (1904): 315–324. **Powell-Cotton.**

Notes on a Journey through East Africa and Northern Uganda. By Major Powell-Cotton. *With Map and Illustrations.*

The journey has already been described in the *Journal.*

Central Africa. *Globus* **86** (1904): 61–63. **David.**

Dr. Davids Forschungen über das Okapi und am Runssoro.

See note in the September number (p. 348).

Central Africa. *La G., B.S.G. Paris* **10** (1904): 72–76. **Pierre.**

M. Charles Pierre: De Brazzaville au Caire par l'Oubangui et le Nil. Par F. Lemoine.

Morocco—Shawias. **Kampffmeyer.**

M. Seminars Orient. Sprachen Berlin **6** (1903): 2 Abt. 1–51.

Säuia in Marokko. Eine historische Studie. Von G. Kampffmeyer. *With Maps.*

Nigeria. *J.R. Colon. I.* **35** (1904): 418–443. **Lugard.**

West African Negroland. By Lady Lugard.

North Africa. *C. Rd.* **138** (1904): 1443–1445. **Ballore.**

Sur les conditions générales de la sismicité des pays barbaresques. Note de F. de Montessus de Ballore.

Rhodesia. *Rep. S. African Assoc.* (1903): 480–491. **White.**

The less-known Ruins in Rhodesia. By F. White. *With Illustrations.*

Rhodesia—Zimbabwe. *Rep. S. African Assoc.* (1903): 504–515. **Hall.**

Great Zimbabwe. By R. N. Hall.

Somaliland. *Sitzb. K.P.A.W. Berlin* (1904): 355–416. **Engler.**

Ueber die Vegetationsverhältnisse des Somalilandes. Von A. Engler. *With Map.*

Noticed in the September number (p. 349).

Somaliland. *Scottish G. Mag.* **20** (1904): 225–234. **M'Hardy.**

Somaliland. By Captain R. A. M'Hardy.

South Africa. *Rep. South African Assoc.* (1903): 251–257. **Marloth.**

Presidential Address. [Section B.] The Historical Development of the Geographical Botany of Southern Africa. By R. Marloth.

South Africa—Forestry. *Rep. South African Assoc.* (1903): 354–361. **Hutchins.**

Some Aspects of South African Forestry. By D. E. Hutchins.

South Africa—Irrigation. *Rep. South African Assoc.* (1903): 373-382. **Westhofen.**
The Irrigation Question in South Africa. By W. Westhofen.

South Africa—Meteorology. *Rep. South African Assoc.* (1903): 119-143. **Sutton.**
The Determination of Mean Results from Meteorological Observations made at Second-order Stations on the Table-Land of South Africa. By J. R. Sutton.

Sudan. *La G., B.S.G. Paris* 9 (1904): 343-368. **Chevalier.**
De l'Oubangui au lac Tchad à travers le bassin du Chari. Par A. Chevalier. *Map.*
See article in the August number.

Transvaal. *T. Geolog. S. South Africa* 7 (1904): 51-56. **Holmes.**
Some Notes on the Geology of the Northern Transvaal. By G. G. Holmes. *With Map and Sections.*

Transvaal. *T. Geolog. S. South Africa* 7 (1904): 18-26. **Mellor.**
On some Glaciated Land Surfaces occurring in the District between Pretoria and Balmoral, with Notes on the Extent and Distribution of the Glacial Conglomerate in the same area. By E. T. Mellor. [*Map and Plates to follow.*]

Transvaal. *Transvaal Agricultural J.* 2 (1904): 322-329. **Pease.**
Camels for the Transvaal. By Sir A. E. Pease, Bart.

Tunis. *Ann. G.* 13 (1904): 145-170. **Monchicourt.**
La région de Tunis. Par C. Monchicourt. *With Map and Illustrations.*
A careful study of the physical and human geography of the districts immediately adjoining (and including) the city of Tunis.

West Africa. *Questions Dipl. et Colon.* 17 (1904): 736-742. **Aspe-Fleurimont.**
Les îles de Los et la Gambie.—A propos de la convention franco-anglaise du 8 avril. Par Aspe-Fleurimont. *With Map.*

West Africa. *La G., B.S.G. Paris* 9 (1904): 321-342. **Lenfant.**
De l'Atlantique au Tchad par le Niger et la Bénoué. Par — Lenfant. *With Map and Illustration.*
See article in the August number.

West Africa. *Rev. G.* 28 (1904): 206-211. **Pelet.**
Les primitifs et la mission Lenfant. Niger, Bénoué, Tchad. Par P. Pelet. *With Illustrations.*
On the historic cartography of the region explored by Lenfant.

NORTH AMERICA.

Alaska. **Schrader and Peters.**
A Reconnaissance in Northern Alaska, across the Rocky Mountains, along Koyukuk, John, Anaktuvuk, and Colville Rivers, and the Arctic Coast to Cape Lisburne, in 1901. By F. C. Schrader, with notes by W. J. Peters. (United States Geological Survey, Professional Paper No. 20.) Washington, 1904. Size 11½ × 9, pp. 140. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

Alaska. *B. American G.S.* 36 (1904): 403-408. ——
A Reconnaissance in Northern Alaska. *With Map.*
Based on Mr. Schrader's report on the expedition under Mr. W. J. Peters in 1901.

Alaska—Geology. **Emerson and others.**
Harriman Alaska Expedition, with co-operation of Washington Academy of Sciences. Alaska. Volume iv. 'Geology and Palæontology.' By B. K. Emerson, Charles Palache, William H. Dall, E. O. Ulrich, and F. H. Knowlton. New York: Doubleday, Page & Co., 1904. Size 10½ × 7½, pp. x. and 174. *Map and Plates. Price* $5.00 *net. Presented by the Publishers.* [To be reviewed.]

Alaska—Glaciers. *T. and P.G.S. Pacific* 3 (1904): pp. 98. **Davidson.**
The Glaciers of Alaska that are shown on Russian Charts or mentioned in older narratives. By Dr. G. Davidson. *Charts. Also separate copy, presented by the Author.*

Alaska—Mount McKinley. *B. American G.S.* 36 (1904): 321-327. **Cook.**
Round Mount McKinley. By F. A. Cook. *With Map.*
See note in the Monthly Record (*ante*, p. 592).

Canada. *La G., B.S.G. Paris* **10** (1904): 19–27. **Reclus.**

Les Canadiens français d'après le recensement de 1901. Par O. Reclus.

United States. *J. Geology* **12** (1904): 94–105. **Iddings.**

A Fracture Valley System. By J. P. Iddings. *With Map.*

United States—California. **McAdie.**

Climatology of California. Prepared . . . by A. G. McAdie. (U.S. Department of Agriculture, Weather Bureau. Bulletin L.) Washington, 1903. Size 12 × 9½, pp. 270. *Diagrams and Illustrations. Presented by the U.S. Department of Agriculture, Weather Bureau.*

United States—California. *Science* **19** (1904): 912–917. **Merriam.**

Distribution of Indian Tribes in the Southern Sierra and adjacent parts of the San Joaquin Valley, California. By Dr. C. H. Merriam.

United States—Coast and Geodetic Survey. ——

Report of the Superintendent of the Coast and Geodetic Survey, showing the progress of the work from July 1, 1902, to June 30, 1903. Washington, 1903. Size 12 × 9, pp. 1032. *Maps and Illustrations. Presented by the U.S. Coast and Geodetic Survey.*

United States—Deserts. **Burdick.**

The Mystic Mid-Region. The Deserts of the South-West. By A. J. Burdick. New York and London: G. P. Putnam's Sons, 1904. Size 8½ × 6, pp. x. and 238. *Illustrations. Price 9s. net.*

Vivid descriptions of some of the deserts of Colorado, California, etc.

United States—Early Travel. **Thwaites.**

Early Western Travels, 1748–1846. . . . Edited with Notes, Introductions, Index, etc., by R. G. Thwaites, LL.D. Vol. II. John Long's Journal, 1768–1782. Vol. III. André Michaux's Travels into Kentucky, 1793–96. François André Michaux's Travels West of Alleghany Mountains, 1802. Thaddeus Mason Harris's Journal of a Tour North-west of Alleghany Mountains, 1803. Vol. IV. Cuming's Tour to the Western Country, 1807–1809. Vol. V. Bradbury's Travels in the Interior of America, 1809–1811. Cleveland, Ohio: The Arthur H. Clark Company, 1904. Size 9½ × 6½, pp. (vol. ii.) 330; (vol. iii.) 382; (vol. iv.) 378; (vol. v.) 320. *Maps and Portrait. Price (each vol.)* 16*s.* 8*d.*

United States—Fisheries. *National G. Mag.* **15** (1904): 191–212. **Evermann.**

The Bureau of Fisheries. How the Rich Fisheries of the United States are Protected and New Fishing Grounds discovered and created. By Dr. B. W. Evermann. *With Illustrations.*

United States—Glacial Features. *J. Geology* **12** (1904): 133–151. **Matson.**

A Contribution to the Study of the Interglacial Gorge Problem. By G. C. Matson. *With Illustrations.*

United States—Historical. **Hulbert.**

Historic Highways of America. By A. B. Hulbert. Vol. 8.—Military Roads of the Mississippi Basin. The Conquest of the Old North-West. Vol. 9.—Waterways of Westward Expansion. The Ohio River and its Tributaries. Vol. 10.—The Cumberland Road. Vols. 11 and 12.—Pioneer Roads and Experiences of Travelers (vols. i. and ii.). Cleveland, Ohio: The Arthur H. Clark Company, 1903–1904. Size 8 × 5½, pp. (vol. 8) 238; (vol. 9) 220; (vol. 10) 208; (vol. 11) 202; (vol. 12) 202. *Maps and Illustrations.*

United States—Illinois. *J. Geology* **12** (1904): 152–160. **Hubbard.**

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The author accompanied Baron E. Nordenskiöld.

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La République Argentine en 1904; le progrès des industries pastorale et agricole. Par E. Daireaux.

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See note in the *Journal* for August (p. 226).

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Disposition of Rainfall in the Basin of the Chagres. By General H. L. Abbot. *With Diagrams.*

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A List of Books, Magazine Articles, and Maps relating to Paraguay. Books, 1638–1903. Maps, 1593–1903. Prepared by J. S. Decoud. A Supplement to the Handbook of Paraguay, published in September, 1902, by the International Bureau of the American Republics. Washington, 1904. Size 9 × 6, pp. 54.

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Col. Pedro Portillo's Expedition. The Rivers Apurímac, Mantaro, Ené, Perené, Tambo, and Upper Ucayali (Peru). By D. B. Adamson. *With Map.*
On a Peruvian Government expedition in 1900.

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Mineral Industries of Porto Rico. By William F. Willoughby. Size 11½ × 9,

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Sur les hauts plateaux de l'Amérique du Sud. Par M. le comte Georges de Créqui-Montfort. Par F. Lemoine.

See note in the *Journal* for April, 1904 (p. 525).

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Die Schwarzen Flüsse Südamerikas. Von Dr. J. Reindl.

Cf. note in the *Journal* for August, 1903, on a more extended paper by the same author.

POLAR REGIONS.

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Neues aus der amerikanischen Antarktis. Von W. Krebs. *With Map.*

On the work of the Swedish and Scottish expeditions.

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Zur Frage nach der Existenz von Terminationland. *With Map.*

The writer holds with Balch that it would be premature to remove Termination Land entirely from the map, though its position may differ from that supposed by Wilkes.

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Some Indications of Land in the Vicinity of the North Pole. By R. A. Harris. *With Map.*

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An old story of Arctic Exploration.

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Arkæologiske Undersøgelser i Godthaabs og Frederikshaabs Distrikter i Grønland foretagne i Aaret 1903 af Kaptain D. Bruun. *With Map and Illustrations.*

Greenland. **Amdrup.**

Observations Astronomiques, Météorologiques et Magnétiques de Tasinsak dans le district d'Angmagsalik 1898–99. Faites par l'Expédition Danoise sous la direction de G. C. Amdrup. Copenhague: G. E. C. Gad, 1904. Size 14 × 9, pp. 6, 4, 20, xxx., 14, 8, and xiv. *Maps and Diagrams. Presented by M. G. C. Amdrup.*

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Le Spitzberg. Notes de voyages en 1902. Par A. Brun.

Spitsbergen. **Leclercq.**

Les explorateurs du Spitzberg, par J. Leclercq. (Extrait des Bulletins de l'Académie royale de Belgique (classe des lettres, etc.) No. 5 (mai), 1904.) Bruxelles, 1904. Size 9 × 6, pp. 303–346.

Spitsbergen. **Leclercq.**

Une croisière au Spitsberg sur un yacht polaire. Par Jules Leclercq. Paris: Plon-Nourrit et Cie., 1904. Size 7½ × 5, pp. iv. and 292. *Map and Illustrations. Presented by the Author.*

The author emphasises the present accessibility of Spitsbergen to the Tourist and its scenic beauties. Besides describing his own visit, he sketches the history of European relations with the islands.

Spitsbergen. *B. Lettres, etc., A. R. Belgique* (1904): 303–346. **Leclercq.**

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MATHEMATICAL GEOGRAPHY.

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Die Fortschritte der Kartenprojektionslehre, Kartenzeichnung und -Vervielfältigung, sowie der Kartenmessung. Von Dr. H. Haack. (From the *Geogr. Jahrbuch*, xxvi. 1904.) Size 8½ × 5½, pp. 359–422. *Presented by the Author.*

Surveying. *M. k. u. k. Militärg. I.* **23** (1903): 182–212. **Hübl.**
Die stereophotogrammetrische Terrainaufnahme. Von A. Freiherrn von Hübl. *With Plates.*

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Der Hodograph von Th. Ferguson. Von Dr. H. v. Hasenkamp.

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Coasts. *Minutes of P.I. Civil Engineers* **156** (1904): 215–302. **Carey.**
The Sanding-up of Tidal Harbours. By A. E. Carey. *With Plans.*

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La sismicité, critérium de l'âge géologique d'une chaîne ou d'une région. Note de M. de Montessus de Ballore.

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Les variations périodiques des glaciers. Neuvième Rapport 1903, rédigé par Dr. H. F. Reid et E. Muret. (Extrait des *Archives des Sciences physiques et naturelles*, t. xviii., 1904.) Genève: Georg & Cie., 1904. Size 9 × 6, pp. 36.

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One Cause of Autumn Mists. By J. B. Cohen, PH.D. *With Diagram.*
The cause alluded to is the descent of cold air from upper levels to valley bottoms.

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The varying distribution of Atmospheric Pressure over the Surface of the Earth. By L. Bonacina.

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Sur la 5e Campagne Scientifique de la *Princesse Alice II.* Note de S. A. le Prince Albert de Monaco.

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Campagne Scientifique du yacht *Princesse-Alice* en 1903. Observations sur la Sardine, sur le Plankton, sur les Cétacés, sur des filets nouveaux, etc. Avec résumé esperanto. Par le Dr. J. Richard.

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Mesure des courants marins au moyen de l'analyse physique et chimique d'échantillons d'eaux récoltés en séries. Par J. Thoulet. *With Diagrams.*

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Die grosse Eistrift bei der Neufundlandbank und die Wärmeverhältnisse des Meerwassers im Jahre 1903. Von Dr. G. Schott. *With Diagrams.*

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La Dottrina della Marea nell' antichità classica. Memoria di Roberto Almagià.

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Volcanic Origin of Oil. By E. Coste.
The writer argues in support of his theory that petroleum is inorganic in origin, and the result of solfataric emanations.

Phytogeography—Olive. *Petermanns M., Ergänzungsh.* 147 (1904): pp. 88. **Fischer.**
Der Ölbaum. Seine geografische Verbreitung, seine wirtschaftliche und kulturhistorische Bedeutung. Von Prof. Dr. T. Fischer. *With Map.*

See *ante*, p. 595.

Terrestrial Magnetism. *Sitzb. K.B.A.W. München* (1904): 29-39. **Messerschmitt.**
Das magnetische Ungewitter vom 31. Oktober 1903. Von J. B. Messerschmitt. *With Diagram.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

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Das Weltkabelnetz. Von Dr. T. Lenschau. ('Angewandte Geographie,' I. Serie, 1 Heft.) Halle a. S.: Gebauer-Schwetschke Druckerei, 1903. Size 10 × 6½, pp. 74. *Map.*

Historical—Early Voyages. **Hakluyt.**
The Principal Navigations, Voyages, Traffiques and Discoveries of the English Nation. By Richard Hakluyt. Vols. vii.-viii. Glasgow: James MacLehose & Sons, 1904 Size 9 × 6, pp. (vol. vii.) xvi. and 465; (vol. viii.) xiv. and 486. *Portraits and Maps. Presented by the Publishers.*

Historical—Quiros' Voyages. **Markham.**
The Voyages of Pedro Fernandez de Quiros, 1595-1606. Translated and Edited by Sir Clements Markham, K.C.B. 2 vols. London: Printed for the Hakluyt Society, 1904. Size 9 × 6, pp. xlviii. and 556. *Maps. Presented by the Hakluyt Society.* [To be reviewed.]

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Juan Díaz de Solís. Estudio histórico. Por S. A. Lafone Quevedo. Buenos Aires, 1903. Size 10 × 6½, pp. 36. *Presented by the Author.*

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Geschichte der Erdkenntnis und der geographischen Forschung zugleich Versuch einer Würdigung beider in ihrer Bedeutung für die Kulturentwicklung der Menschheit. Von Prof. Dr. Karl Weule. Berlin: Bong & Co., 1904. Size 12 × 8½, pp. xii., 180, and 256. *Maps and Illustrations. Presented by the Publishers.*

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Zur Forschung über alte Schiffstypen. C. Schiffsfahrzeuge in Albanien u. Macedonien. Von P. Traegar. (Separatabdruck aus dem Correspondenz-Blatt der Deutschen anthropologischen Gesellschaft. Nr. 4. u. 5, 1904.) Size 11 × 8½, pp. 15-28. *Illustrations. Presented by the Author.*

Political—Anglo-French Agreement. *Rev. Française* **29** (1904): 257-276. **Vasco.**
L'accord colonial Franco-Anglais. Par G. Vasco. *With Maps.*

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Ueber Karten der Volksdichte. Von Prof. Dr. Ed. Brückner mit einer Karte der Volksdichte des bündnerischen Rheingebietes, von Dr. H. Zivier. (Separatabdruck aus der "Z. für schweizerische Statistik," 1904.) Size 11½ × 9, pp. 6. *Presented by the Author.*

Sociology. *Rep. S. African Assoc.* (1903): 462-479. **Fremantle.**
The Sociology of Comte, with special reference to the Political Conditions of Young Countries. By H. E. S. Fremantle.

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Brunel. *Mouvement G.* **21** (1904): 352-355. **Leclercq.**
Olivier Brunel, un navigateur belge dans les régions boréales au XVI^e^ Siècle. Par J. Leclercq.
Brunel undertook a voyage to the north in 1584, and may be considered to have shown the Dutch the way to the far northern seas.

Cabot. *Rev. G. Italiana* **11** (1904): 177-184. **Gribaudi.**
Ancora sulla patria di Giovanni Caboto. Prof. P. Gribaudi.

Coillard. *South Africa* **63** (1904): 49. **Gibbons.**
The late Rev. François Coillard. By Major A. St. H. Gibbons. *With Portrait.*

General. **Wolkenhauer.**
Geographische Nekrologie für die Jahre 1902 and 1903. Von Prof. Dr. W. Wolkenhauer. (From H. Wagner's *Geogr. Jahrbuch*, xxvi. Bd., 1904.) Size 8½ × 5½, pp. 423-446. *Presented by the Author.*

Harness. **Collinson and Webber.**

General Sir Henry Drury Harness, K.C.B., Colonel Commandant Royal Engineers. The Material for this Memoir was collected and arranged by the late General Collinson and edited by General Webber, C.B. London: 1903. Size 9 × 6, pp. viii. and 296. *Presented by the Royal Engineers Institute.*

This distinguished Engineer officer took part in the siege and capture of Lucknow during the Mutiny, after which he was for five years Director of the Royal Engineer School at Chatham, in which he inaugurated some important reforms.

Hartl. *M. K. u. K. Militärg. I.* **23** (1903): 41–47. **Sterneck.**

Oberst Dr. Heinrich Hartl. Von Dr. R. von Sterneck.

This well-known geodesist died in April 3, 1903.

Stanley. *J. African S.* **3** (1904): 449–463. **Johnston.**

Stanley: A Biographical Notice. By Sir H. H. Johnston. *With Portrait.*

Stanley. *Deutsch. Rundschau G.* **26** (1904): 470–472. ———

Henry M. Stanley. *With Portrait.*

GENERAL.

Almanac. ———

The American Ephemeris and Nautical Almanac for the year 1907. Washington, Bureau of Equipment, 1903. Size 10½ × 7½, pp. viii. and 602. *Diagrams.*

Babylonia and Egypt. **Geere.**

By Nile and Euphrates. A Record of Discovery and Adventure. By H. V. Geere. Edinburgh: T. & T. Clark, 1904. Size 9 × 6, pp. xii. and 356. *Maps and Illustrations. Price* 8*s.* 6*d. net. Presented by the Publishers.*

The author went out to the East in 1895 as a member of the Expedition of the University of Pennsylvania for excavations at Nippur. The present volume gives a readable account of his experiences, with sketches of places and people.

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Annales de Géographie. XIII^e^ Bibliographie Géographique Annuelle, 1903. Publiée sous la direction de L. Raveneau. Paris: A. Colin, [1904]. Size 10½ × 6½, pp. 320.

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Catalogue of the London Library, St. James's Square, London. Supplement 1 (1902 and 1903). By C. T. Hagberg Wright, LL.D. London: Williams & Norgate, 1904. Size 11 × 8½, pp. 180. *Presented by the London Library.*

British Empire—Cotton. *Scottish G. Mag.* **20** (1904): 354–371. ———

Cotton Cultivation in the British Empire and Egypt. *With Map.*

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Geography in the United States. An Address by Wm. Morris Davis, Vice-President and Chairman of Section E for 1903, before the Section of Geology and Geography, American Association for the Advancement of Science, St. Louis Meeting, December, 1903—January, 1904. Washington, 1903. Size 10 × 6½, pp. 32.

German Colonies. ———

Die deutsch Kolonial Gesetzgebung. Sammlung der auf die deutschen Schutzgebiete bezüglichen Gesetze, Verordnungen, Erlasse und internationalen Vereinbarungen mit Anmerkungen, Sachregister. Siebenter Teil, 1903. Berlin: E. S. Mittler und Sohn, 1904. Size 9½ × 6½, pp. xii. and 330.

Livingstone College. ———

Livingstone College Year-Book [1904], containing Hints to Travellers in matters of Health, Outfit, and Travel. Travellers' Health Bureau, Livingstone College, Leyton, E. Size 7½ × 5, pp. 96. *Illustrations. Price* 6*d.*

Contains abundant evidence of the excellent work done by the College.

Oxford—Daubeny Laboratory. **Günther.**

A History of the Daubeny Laboratory, Magdalen College, Oxford. To which is appended a list of the Writings of Dr. Daubeny, and a Register of the Names of Persons who have attended the Chemical Lectures of Dr. Daubeny from 1822 to 1867; as well as of those who have received instruction in the Laboratory up to the present time. By R. T. Günther. With a Preface by the President of

Magdalen. London: H. Frowde, 1904. Size 9 × 6, pp. viii. and 138. *Plates. Price 5s. net. Presented by the Author.*

The laboratory was originally founded in 1847 by Dr. Daubeny, one of the pioneers of Science at Oxford. The book describes the work done at the laboratory since its foundation, and gives an account of the meteorological records kept, with tables of observations of the temperature of the river Cherwell from 1882 onwards.

Units of Length, etc. **Warren.**

The Ancient Cubit and our Weights and Measures. By Lieut.-General Sir C. Warren, G.C.M.G., etc. London: Palestine Exploration Fund, 1903. Size 7½ × 5, pp. xx. and 132.

The author endeavours to trace the origin of existing weights and measures to the Babylonian cubit.

Year-Book. **Wagner.**

Geographisches Jahrbuch. XXVI. Band, 1903 . . . herausgegeben von H. Wagner. Zweite Hälfte. Gotha: Justus Perthes, 1904. Size 9 × 6, pp. 249–496.

This part treats of recent progress in various branches of general geography, including anthropogeography, geographical meteorology, the science of map-projections, etc.

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Germany. **Königl. Preuss. Landes-Aufnahme**

Karte des Deutschen Reiches. Scale 1:100,000 or 1·6 stat. mile to an inch. Sheets: 315, Loburg; 316, Belzig. Herausgegeben von der Kartogr. Abtheilung der Kgl. Preuss. Landes-Aufnahme, 1904. *Price* 1.50 *mark each sheet.*

Naples. **Istituto Geografico Militare.**

Napoli e Dintorni. Scale 1:100,000 or 1·6 stat. mile to an inch. Istituto geografico militare, 1904. *Presented by Prof. Guido Cora.*

Vesuvius. **Istituto Geografico Militare.**

Cono Vesuviano. Scale 1:10,000 or 6·3 inches to 1 stat. mile. Levata nel 1900.
Il Vesuvio. Scale 1:25,000 or 2·5 inches to 1 stat. mile. Levata nel 1900.
Istituto geografico militare. *Presented by Prof. Guido Cora.*

The sheets of the large-scale Government Map of Italy, including the neighbourhood of Vesuvius.

ASIA.

Asia. **Service Géographique de l'Armée, Paris.**

Asie. Scale 1:1,000,000 or 15·8 stat. miles to an inch. Sheet 48 N. 132 E. Ningouta. Paris: Service Géographique de l'Armée, 1904.

Japan. **Japanese Imperial Geological Survey.**

Topographical Map of Japan. Scale 1:200,000 or 3·1 stat miles to an inch. Sheets: Sadowara, Shinjo, Toba. Tokyo: Imperial Geological Survey, 1904. *Presented by the Imperial Geological Survey of Japan.*

AFRICA.

Africa. **Intelligence Division, War Office.**

Africa. Scale 1:250,000 or 3·9 stat. miles to an inch. Egyptian Sudan. Sheets: 55-C, Geili; 55-D, Rera; 55-G, Wad Medani; (Provisional) 55-P, Middle Dinder; 66-C, Roseires. London: Intelligence Division, War Office, 1904. *Price* 1s. 6d. *each sheet. Presented by the Director of Military Operations.*

The region immediately to the east of Khartum is shown on these sheets, which form part of the important map of Africa now being compiled at the Intelligence Division of the War Office.

Egypt. **Survey Department, Cairo.**

Topographical map of Gharbia Province. Scale 1:10,000 or 6·3 inches to 1 stat. mile. Sheets: N.W. 36-1, 36-2, 36-3, 37-2, 37-4, 38-6, 39-1, 39-3, 39-5, 40-2. Cairo: Survey Department, Public Works Ministry, 1904. *Presented by the Director-General, Survey Department, Cairo.*

AMERICA.

Central America. **Sapper.**

Karte von West- Salvador und von Süd- und West Guatemala. Auf Grund eigener Aufnahmen 1899-1902, der Karten von Guatemala von Theodor Paschke 1889 und

Miles Rock 1897, sowie der Aufnahmen der interkontinentalen Eisenbahnkommission 1891–93, Corps 1. Entworfen von Karl Sapper, 1904. Scale 1 : 500,000 or 7·8 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 14. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

The height of the land is shown by colour tinting and contours at intervals varying from 100 metres to 500 metres. Altogether there are eleven tints; first, light green, showing land below 100 metres; next two light shades of sienna for land lying between 100 to 250 metres and 250 to 500 metres; and finally eight shades of darker brown, at 500 metres intervals, for heights from 500 to over 4000 metres. The result is decidedly effective, and the map is an important one, supplying fresh information concerning these imperfectly surveyed Central American States. The authorities upon which the map is based are stated in the title.

Salvador. **Sapper.**

Karte der Izalco Vulkane (Republik Salvador). Auf Grund eigener Aufnahmen aus den Jahren 1895, 1897 u. 1902, und der Originalkarten von Karl v. Seebach, und der interkontinentalen Eisenbahnkommission, entworfen von Karl Sapper. Scale 1 : 100,000 or 1·6 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 15. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

POLAR REGIONS.

Antarctic Regions. **Petermanns Geographische Mitteilungen.**

Entwicklung unserer Kenntnis der Länder südlich von Amerika, 1873–1903. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 16. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. Lieferung 14. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50pf. each part.*

Part 14 contains the following maps: No. 17, Europe, on the scale of 1 : 15,000,000; No. 55, France, 1 : 2,800,000; No. 75, Turkestan and Northern India, 1 : 10,000,000.

World. **Peip.**

Taschen-Atlas über alle Teile der Erde. In 36 Haupt- und 70 Nebenkarten von Chr. Peip. Mit geographisch-statistischen Notizen von Otto Weber. Stuttgart und Leipzig: Deutsche Verlags-Anstalt, 1904.

This is one of the many little German pocket atlases which have appeared in recent years, and includes thirty-six principal coloured maps and seventy plans and insets, preceded by statistical information and notes by Otto Weber. Altogether the atlas contains a great deal of information within the small compass of 4 inches by 6¼ inches, but many of the maps are overcrowded and not clearly legible. Only one map of the British Isles is given, and that is a general map on a very small scale, upon which there are several mistakes in the place-names.

World. **Petrie and Schokalsky.**

Marck's Large General Table Atlas. Edited by Prof. E. J. Petrie and Colonel J. de Schokalsky. Part 8. St. Petersburg: A. F. Marks, 1904. [In Russian.] *Presented by the Publisher.*

The standard of excellence which characterized the first issues of this atlas is being well maintained, as will be seen by an inspection of the eighth part, which has just been published. The maps, which are four in number, are well drawn and clearly printed. They are as follows: No. 10, a chart of the world on Mercator's projection, showing colonial possessions, steamer routes, etc., with three inset plans; No. 28, a Black sea sheet of a map of European Russia on the scale of 1 : 2,000,000; No. 32, Belgium, Netherlands, and Luxemburg, 1 : 1,000,000; No. 56, Plans of the Pacific island groups on the scales of 1 : 9,000,000, 1 : 4,500,000, 1 : 2,250,000, and 1 : 1,125,000.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during July and August, 1904. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
1683 m	= 14·7	England, west coast. Padstow harbour. 3*s.*
1919 m	= 9·9	Scotland. Hebrides, Lewis island:—Stornoway harbour. 1*s.* 6*d.*
3400 m	= 1·96	England. Channel islands:—Guernsey, Herm, and Sark. 2*s.* 6*d.*
3442 m	= 4·0	Lapland. Plans on the north coast of Russian Lapland:—Ivanovski bay. 1*s.* 6*d.*
3435 m	= Var.	Sweden. Plans on the east coast:—The Narrows of Kalmar sound, entrance to Gefle, entrance to Umea. 1*s.* 6*d.*
3414 m	= 1·0	France, south coast:—Approaches to Marseille. 2*s.* 6*d.*
2285 m	= 2·8 / 1·8	Black sea. Varna:—Baljik bay. 1*s.* 6*d.*
3406 m	= 2·95	Newfoundland, east coast:—Bay of Exploits, Sheet I. (North). 2*s.* 6*d.*
3417 m	= 1·91 / 3·98	British Columbia. Vancouver island:—Hanson island to Beaver harbour, including Broughton strait. Port McNeill, 3*s.*
3431 m	= 0·82	Africa, west coast:—Cape Coast Castle to Barako point. 2*s.* 6*d.*
3432 m	= 0·82	Africa, west coast:—Barako point to Great Ningo. 2*s.* 6*d.*
3423 m	= 1·5 / 8·0	Africa, west coast:—Old Calabar river. Duke town anchorage. 2*s.* 6*d.*
3370 m	= 0·73	Philippine islands:—San Bernardino strait and approaches. 2*s.* 6*d.*
3429 m	= 4·7	China, east coast. Hong Kong island:—East Lamma channel. 2*s.* 6*d.*
3437 m	= 5·95	Japan. Nipon, west coast:—Hagi approaches. 1*s.* 6*d.*
431 m	= 4·65	Australia, west coast:—Swan river, North Fremantle to Perth. 2*s.* 6*d.*
1347		Peru. Plans on the coast. Plan added:—Huacho anchorage.
632		Africa, west coast. Walfisch bay to Orange river. Plan added:—Prince of Wales bay.
3311		Eastern archipelago. Anchorages on the north coast of Java. Plan added:—Tegal road.
1023		China, south coast. Boddam cove. Plan added:—Nam sha bay.
1256		China, north coast. Gulfs of Pe chili and Liau tung. Plan added:—Sketch of entrance and bar of the Yang kiao ko.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
1683	Padstow harbour.	New plan. Padstow harbour	1683
1919	Stornoway harbour.	New plan. Stornoway harbour	1919
2842b	Baltic sea. Plan on this sheet. The Narrows of Kalmar sound	New plan. Narrows of Kalmar sound on sheet	3435
2377	Ports on the east coast of Sweden. Plan on this sheet:—Kalmar sound narrows.		
2285	Varna.	New plan. Varna. Baljik bay on sheet	2285
2287	Baljik bay.		
2395	Gulf of Magnok. Plan on this sheet.	New chart. San Benardino strait and approaches	3370

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1188, The World:—Coal and telegraph chart. 34, England, south coast:—The Scilly isles. 1765, Ireland, south coast:—Queenstown and port of Cork (outer sheet). 1777, Ireland, south coast:—Queenstown and port of Cork (inner sheet). 3384, Ireland, south coast:—Queenstown. 2246, Baltic sea: Port Baltic to Hogland. 2694, France, west coast:—channels between Ile d'Ouessant and the mainland. 2554, Mediterranean sea, Italy:—Leghorn roadstead, etc. 2379, Black sea:—Kherson or Dniepr bay. 893, Newfoundland:—Burin harbour to Devil bay. 761, West India islands and Caribbean sea: Sheet I. 762, West India islands and Caribbean sea: Sheet II. 486, West Indies:—Jamaica, and the Pedro bank. 1274, Gulf of Mexico:—Tortugas cays to Cape San Blas. 23,

Chile:—channels between Magellan strait and gulf of Trinidad. 631, South America, west coast:—Smyth channel from south entrance to Fortune bay. 2840, British Columbia:—Haro strait and Middle channel. 759A, Madagascar:—Cape St. Andrew to Bevato island. 821, Bay of Bengal:—Elephant point to Cheduba strait. 833, Bay of Bengal:—Rangoon river and approaches. 2153, Malacca strait:—Port Swettenham. 928, Sulu archipelago. 2577, Philippine islands:—Between St. Bernardino and Mindoro strait. 3283, Philippine islands:—Port Salomague and approach, Port Sual. 127, Japan:—Hirado no seto to Simonoseki strait. 1674, Australia, east coast:—Brisbane river. 2614, New Zealand:—Kaipara harbour. 2540, New Zealand:—Awarua or Bluff harbour and New river. 3044, Celebes:—Ujong Jonga to Ujong kassi.

(*J. D. Potter, Agent.*)

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for October, 1904. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for September, 1904, and of the North Atlantic Ocean and North Pacific Ocean for October, 1904. U.S. Hydrographic Office, Washington, D.C., 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Java. **Sternberg.**

Ninety-five photographs of Java, taken by F. Sternberg, Esq. *Presented by F. Sternberg, Esq.*

An interesting set of photographs illustrating the scenery, people, ancient rock-carvings, and monuments.

(1) Canal at Batavia; (2) Museum, Batavia; (3) "Gamelan," a musical instrument; (4 and 5) Masks used in Javanese dances; (6) Car of the steam tramway, Batavia to Weltevreden; (7) Javanese policemen; (8) Sado, Javanese conveyance; (9) Primitive way of watering streets at Batavia; (10) Men with powdered faces; (11 and 12) Women with powdered faces; (13) Old cannon at Batavia to which Javanese women make pilgrimages; (14) Live python; (15) Railway station, Buitenzorg; (16) Avenue in Botanical Gardens, Buitenzorg; (17) Inscription on tomb of Stamford Raffle's first wife, Buitenzorg; (18) Residence of Governor-General of Dutch East Indies; (19-21) Views in Botanical Gardens, Buitenzorg; (22) A group of Javanese in Buitenzorg; (23) Klong Tong, Chinese hawker and coolie; (24) House and palms; (25) The morning bath; (26) Javanese house, Buitenzorg; (27) Guard house and Toug Tong; (28 and 29) Chinamen, Buitenzorg; (30) Hat seller, Buitenzorg; (31) Prisoners getting sand from river; (32) Typical group, Buitenzorg; (33) Palm-wine seller, Buitenzorg; (34) Javanese dancing-girls; (35) Luncheon party, Buitenzorg; (36) Javanese open-air restaurant; (37) Javanese refreshment hawker; (38) Picturesque bridge; (39 and 40) River scenes at Surabaya; (41) Chinese bazaar, Surabaya (42); Chinese pawnshop, Surabaya; (43) Clock Tower erected by British residents to commemorate Queen Victoria's Jubilee, Surabaya; (44) Javanese sailing-craft; (45) Trikar or bullock-cart, Surabaya; (46) Residential street, Surabaya; (47) A group, Surabaya; (48) *En route* for the mountains; (49) *En route* to Tosari; (50) A mountain inn; (51) Road to Tosari; (52) Village of Ledok; (53) Javanese boy carrying Mr. Sternberg's camera; (54) Group at Tosari; (55) Waiting for the wedding procession; (56) The bride; (57) Open-air shop, Tosari; (58) Batok mountain; (59) Sand sea and wall of Bromo; (60) View looking down the active Bromo crater; (61) Our party at the Bromo; (62) Monkeys at Blau Water; (63) *En route* for the Boro Boedor ruins; (64) A market on the way; (65) Boro Boedor; (66) Entrance to the Boro Boedor; (67) A gallery at the Boro Boedor; (68-70) Sculpture on Boro Boedor temple; (71) Ruins of Hundred Temples; (72) Figure and Mr. Sternberg at entrance to Hundred Temples; (73 and 74) Bambranan Temple; (75-79) Carvings on Bambranan Temple; (80) Inn at Iokjakarta; (81) Curious trees in front of Kraton, Iokjakarta; (82) Women carrying loads; (83) Javanese country policemen; (84) A primitive yet effective sunshade; (85) Water Kastell, Iokjakarta; (86) Entrance to Water Kastell; (87) Sultan's bath Water Kastell; (88) Railway station, Garoet; (89) Square and Mosque, Garoet; (90) Stickseller with big hat; (91) Village of Bagendit; (92) Raft on lake at Bagendit; (93) Women fishing in lake at Bagendit; (94) On the road to Tjipanas; (95) Tjipanas.

Persia. **Sykes.**

Two hundred and eighty-two photographs of Eastern Persia, taken by H. R. Sykes, Esq., M.A. *Presented by H. R. Sykes, Esq., M.A.*

Upon his return to Persia in 1902, Major Sykes, the well-known British consul at Kerman, was accompanied by his cousin, Mr. H. R. Sykes, who has since had good opportunities of visiting some of the little-known districts of the eastern part of the country. He has taken a most interesting set of photographs, copies of which have now been presented by him to the Society. The titles are as follows:—

(1) View of Bandar Abbas from sea, Kuh-i-Ginao beyond; (2) Major Sykes' camp at Kush-Kuh and Kuh-i-Shamil beyond; (3) Major Sykes' camp in the Navargu pass; (4) Natives and huts in the Navargu pass; (5) Natives at Rahdar cutting up dead camel; (6) Ramparts of fort (ruined) at Rudkhana-i-Duzdi; (7) Interior of above fort; (8) Natives and huts in Jiruft valley; (9) Gipsy women in Jiruft; (10) Musicians in Jiruft singing to the accompaniment of drums; (11) Women of Jiruft, weaving jowal; (12) Major and Mrs. Sykes at foot of Ushteran pass, escort of Sikhs of Central Indian Horse; (13) Mounting the Ushteran pass; (14) A caravanserai at Khanch Khatun; (15) On the Bam plain, looking south towards the Jubal Bariz range; (16) Nearing Pa-kenneh from the Gudar-i-Deh-Bekri, the Jumal Bariz range in distance; (17) Tehrud fort, exterior view, north-east; (18) Tehrud fort, interior view, west; (19) Tehrud fort, east, looking north-west; (20) Mill at Sabistan; (21) Hot spring at Abarik, view east; (22) House lent me during my stay at Bam; (23) Takht-i-Ravan; (24) Vali Khan and retinue at Bam fort; (25) The outskirts of Rain; (26) View from summit of Bam fort, looking north; (27) Kuh-i-Hazar from the approach to the Hanaka pass; (28) View from summit of Bam fort, looking south, ruined town in foreground, Jumal Bariz range in distance; (29) Rigan from the fort; (30) View from camping-ground at Dahan-i-Abbas Ali; (31) Members of the Palangi tribe in cave at Dahan-i-Abbas Ali; (32) On the way to the Gishan pass; (33) On the way to the Gishan pass, 2½ miles from Dahan-i-Abbas Ali; (34) View south-west from the top of Gishan pass; (35) Half-mile below summit of Gishan pass, looking east; (36) View of Mil-i-Farhad at 2 miles, looking west; (37) Mil-i-Farhad and Panj Augusht mountains, looking north-east; (38) Shakerabad natives weaving jowal; (39) Yar Amad Khan and suite at Shakerabad; (40) Palm groves and cultivation at Jaghin; (41) Manujan fort, view north-west; (42) Manujan fort, view south; (43) View from Manujan fort, looking north-west towards Kala Kahnu; (44) Mirza Khan and suite at Manujan fort; (45) Plain near the Manujan river, 3 miles from Manujan; (46) Jaghin river and palms; (47) Natives and huts, Jaghin; (48) Kala Kahnu, village and fort; (49) Jaghin: loading up the mules; (50) On the road between Jaghin and Barinti; (51) Confluence of the Rudkhanch-i-Duzdi and the Manujan river, a mile below Barinti; (52 and 53) Looking down the valley of the Minab river; (54) My escort from Jaghin; (55) My caravan crossing the Minab river; (56) Rock cliff in Minab river 15 miles from Barinti; (57) Weathered clay formation in Minab river; (58) Minab fort, built on a conglomerate cliff; (59) Minab; (60) Kuh-i-Shamil from near Kalabi; (61) Palm-grove and Kuh-i-Shamil; (62) Natives reaping near Kush Kuh; (63) Native musicians at Kush Kuh; (64) In the Tang-i-Zindan, where the caravan route leaves the main river-bed; (65) In the Tang-i-Zindan, near the entrance; (65) View in the Tang-i-Zindan; (67) View from the summit of Kotal, looking back over the Tang-i-Zindan; (68) Natives at Sar-i-Sikh, men; (69) Ditto, women and children; (70) Sar-i-Sikh, early morning; (71) Natives at Pur; (72) Our camp at Pur, looking east; (73) The summit of the Gudar-i-Kafanu; (74) The Lalazar range from near the summit of the Kafanu pass; (75) View of Lalazar range from near Bezinjan; (76) Watch-tower between the Kafanu and Zaichu pass; (77) Nagar and the Kuh-i-Chehel-Tan; (78 and 79) Nestorian church at Nagar; (80) The tower of the Nestorian church, Nagar; (81) On the Nagar plain, looking south-west towards Negar; (82) C.M.S. hospital, Kerman: the dispensary; (83) Kerman walls and moat on east side of city; (84) The Masjid gate, Kerman; (85) Kerman: mosque near the Masjid gate; (86 and 87) Kerman: shops in the city; (88) Kerman: mosque without the walls; (89 and 90) Kerman: a caravanserai; (91) Kerman: gate leading from the Meidan into the ark; (92) Kerman: the Negah Khaneh; (93) Kerman: Nurulla Khan's unfurnished house; (94) Kerman: general view from the walls, with Jupar range in distance; (95) Kerman: butcher's shop; (96 and 97) Kerman: the ice-houses; (98) Kerman: woman washing clothes in a kanat; (99) Kerman: the Parsi anjuman; (100) Mohammed Hadi, merchant of Kerman; (101) Kerman: entrance to the British consulate; (102) The Naraujistan garden, Kerman; (103) The consulate, Kerman: Mr. H. R. C. Dobbs starting for Sistan; (104) Soghuk and Kuh-i-Bidkhan; (105) Soghuk; (106) View of houses at Soghuk; (107) Buchakchi tribesmen, rifle-shooting; (108) Chiefs Buchakchi tribe; (109) Head waters of the

Halil Rud above Gugher; (110) Village of Gugher from camp, looking west; (111) Natives and huts, Gugher; (112) The fort at Husbun; (113) Camp at Chaharain; (114) The Kej-ma-Kej pass, 11,500 feet; (115) A "Chaman" in the Lalazar range; (116) The Lalazar range and my camp near Kej-ma-Kej looking north-east; (117) Lalazar range from the top of the watershed looking over Rahbur; (118–120) In the Lalazar range; (121) Woodman in Lalazar range; (122) Nest of the *Lagomys rufescens;* (123) *Ovis ourialis*, July 4, 1903; (124) A school in Rahbur; (125) Rahbur: oxen carrying kah; (126) Threshing corn at Rahbur; (127) Hut at Shirinak where I slept on my way from Rahbur to Mahun; (128) Camp at Robat; (129) Roof of caravanserai, Robat; (130) Caravanserai at Kabuter Khan, showing telegraph material; (131) Camp at Bayaz; (132) Persian and English wires; (133) Caravanserai and pool, Gird Kuh; (134) Gird Kuh, mountain and village; (135) A street in Faraj (Yezd); (136) The village square, Faraj; (137) C.M.S. hospital, Yezd; (138) Interior of one of the wards, C.M.S. hospital, Yezd; (139) Yezd: Dr. White's house and garden; (140) Yezd: view from a roof looking south-west; (141) A Parsi gardener; (142) Outside Yezd, showing the Kuh-Shir; (143) Yezd, looking north-east; (144) The "Pusht-i-Bag" gate, Yezd; (145) Old walls at Yezd; (146) Meidan-i-Shah, Yezd; (147) The ark and moat, Yezd; (148) Yezd: the Meidan Khan; (149 and 150) Meidan-i-Mir Chak-mak, Yezd; (151) Caravanserai, Anjirak, looking east; (152) Anjirak tower; (153) Kharuneh, the west side of village; (154) Kharuneh, the south side of village; (155) Kharuneh, village and aqueduct; (156) Kharuneh, looking north-north-east; (157) Kharuneh, looking north; (158) Kharuneh, and country looking north-east; (159) Kharuneh: the aqueduct; (160) Kharuneh: the Husseiniah; (161) A street, Kharuneh; (162) Kharuneh: view from the middle of village looking south-east; (163) A street, Kharuneh; (164) Rocks near Kharuneh; (165) Ab-ambar between Kharuneh and Rizab; (166) Caravanserai at Rizab; (167) Village of Robat-i-Khan; (168) Hills near Robat-i-Khan; (169) Caravanserai at Dam-i-Dahneh; (170) Camp at Deh Mohammed and Kuh-i-Stilakh; (171) Deh Mohammed, old fort; (172) Espak; (173) Caravanserai Espak; (174) Neigenu: the fort and moat; (175) Neigenu gateway in the old walls; (176) Bridge in salt desert, near Neigenu; (177) The shora, or salt desert; (178) In a caravanserai, Kasimabad; (179) Baluch tents at Marandiz; (180) Houses in Marandiz; (181) Fort at Marandiz; (182) Baluch family, Marandiz; (183) Bridge at Yunsi; (184) Old gate in the walls at Faizabad; (185) Village at the southern foot of the Bidar pass; (186) Village of Kala-i-Kafir; (187) Caravanserai at Sherifabad; (188 and 189) A shop at Sherifabad; (190) Camel-boy, native of Yezd; (191) The new road between Sherifabad and Meshed; (192 and 193) British consulate, Meshed; (194) The British consulate garden, Meshed; (195 and 196) View of the Shrine Meshed from the roof of the Imperial Bank; (197) View of the shrine, showing the Khyaban-i-Païn; (198) The Khyaban-i-Païn; (199 and 200) In the Khyaban-i-Païn, Meshed; (201) Ziarat, stone pinnacles built by the pilgrims on approaching Meshed; (202) The Band-i-Feraiman, the inside view; (203) The Band-i-Feraiman, from the outside; (204) Mill near the Band-i-Feraiman, showing icicles; (205) Heratis on their way to Meshed; (206) Turbat-i-Sheik Jam; the gate of the fort; (207) The shrine at Turbat-i-Sheik Jam; (208) Abambar at Turbat-i-Sheik Jam; (209) The aiwan shrine, Turbat-i-Sheik Jam; (210) The main street, Turbat-i-Sheik Jam; (211) Fakir at Turbat-i-Sheik Jam; (212) Bizg; (213) Door of the fort at Bizg; (214) The Kala Sang at Ustai, looking north; (215) Hoaz on top of Kala Sang; (216) Remains of hoazes, on top of Kala Sang; (217) Ruined madresseh near Rui Khaf; (218) Interior of Madresseh; (219) Tile-work, interior of madresseh; (220) Roof of a room in the madresseh; (221) Natives of Sangan; (222) Natives of Bamrud; (223) Village of Bamrud; (224) Range at Bamrud; (225) Village of Afin; (226) Village of Zehun; (227) Birjund: Abbas Ali Khan, the Karguzar, Abbas Ali Khan's brother-in-law; (228) Prisoners at Birjund; (229–231) View from the old fort; (232) A street in Birjund; (233) The main street, Birjund; (234) A shop in Birjund; (235) A street corner in Birjund; (236) The hatting industry, Birjund; (237) Fort Birjund; (238) House of the governor in Birjund; (239) Mod, where I spent Christmas Day, 1903; (240) Captain Winter's camp at Gorit; (241) Stores and horses, Captain Winter's camp at Gorit; (242) A village wedding, dancing; (243) Chahar Farsaki villagers; (244) Kuh-i-Shah Duzd from near Neh; (245–247) Ruins on Kuh-i-Shah Duzd; (248) The Persc-Afghan Boundary Commission: camp at Gul Chah; (249) Gul-chah; (250) Colonel McMahon's escort; (251) Sistan village: Deh Haji Khamber; (252) Weaving calico in a Sistan village; (253) Village of Taj Mohamed; (254) The Takht-i-Pul, showing one arch; (255) General view of the Takht-i-Pul; (256) Sistanis at Kuh Kul Shah; (257) Sistanis ploughing; (258) Goldsmid's boundary, Persian territory; (259) Duck-shooting on tutins; (260) Hamun, showing puzeh 180 feet high; (261) View of Hamun from puzeh; (262 and 263) The old bed of the Helmund boundary

of Afghanistan by Goldsmid; (264) The south wall, Nasratabad; (265) The main gateway, Nasratabad; (266) The main street, Nasratabad; (267) Windmills at Husseinabad; (268) Colonel McMahon's mission camels dying of influenza; (269) Mr. G. Tate surveying; (270) Kuh Kuh Shah: ruins and modern village; (271) The Akhunzadas escort of Afghan infantry; (272) Baluch levies at the Gymkhana; (273) Colonel McMahon, the Akhundzada on left, Yamin-i-Nizam on right; (274) Asad Ulla Khan at Naibid caravanserai; (275) The top of the Zainalabad pass, 8200 feet, looking north; (276) Zainalabad caravanserai, looking north-east; (277) Mahun, prince's garden in March; (278) Mahun: shrine with Jupar range beyond; (279) Mahun, shrine in the main court; (280) Geological example near Mashiz; (281) Caravanserai of Sinj-i-Tu; (282) Cave used as a caravanserai near Saadetabad.

South Africa. **Sandbach.**

Forty-eight panoramic views of South Africa, taken by Captain William Sandbach in 1901 and 1902. *Presented by Captain William Sandbach.*

A set of panoramic views taken by Captain Sandbach during the Boer war. They measure 11½ inches by 3½ inches, and, apart from their illustrating incidents during the campaign, they are of geographical interest, inasmuch as they serve well to show the character of the country.

(1–25) Views around and about Krawz Kop or Ntunjambili in the Umvoti country, Natal, between Hopetown and Middle Drift on the Tugela river; (26 and 27) Camp at Rockdale, 6 miles south-east of Middelburg; (28–30) Scheipad, Steelpoort valley; (31–33) Paardekloof; (34 and 35) Indaba, to warn Jiaffta, local chief, that peace had been made; (36 and 37) View near Roos Senekal, rocky and thorny bush country; (38) View looking towards Roos Senekal from the north; (39) View looking towards Roos Senekal from the west; (40) Recovery of Krupp howitzer hidden by Boers in the clump of willows; (41) View near Roos Senekal; (42) Camp at Pan, Delagoa bay line between Middelburg and Machadodorp; (43 and 44) View showing ordinary veldt and road, and waggons of a column on the march; (45) Machadodorp; (46) Cape Town from the steamer; (47 and 48) Las Palmas.

Vegetation Types. **Karsten and Schenck.**

Vegetationsbilder, herausgegeben von Dr. G. Karsten und Dr. H. Schenck. Zweite Reihe, Heft 2. Die Mangrove-Vegetation. Von G. Karsten. Jena: Gustav Fischer, 1904. *Price 4 marks.*

The photographs from which the twelve plates in this part have been taken, have been well selected to illustrate mangroves and mangrove swamps, and they convey a good general idea of this remarkable type of vegetation. Prof. G. Karsten, of the Bonn University, who took most of the photographs, furnishes the explanatory text.

Victoria Falls. **Melvill.**

Eleven photographs of the Victoria Falls, Zambezi river, taken by E. H. V. Melvill, Esq. *Presented by E. H. V. Melvill, Esq.*

These very fine bromide enlargements are probably the best photographs of the Victoria Falls hitherto taken. They exhibit the remarkable structural features very clearly, and are generally most instructive and interesting. The mist effect is well shown.

(1) First zigzag below Victoria falls and site of railway bridge; (2) Second and third zigzag, Victoria falls; (3) East end, Victoria falls; (4) Zambezi river above Victoria falls; (5) The Devil's cataract and west end of Victoria falls; (6 and 7) The Devil's cataract, Victoria falls; (8) Above Devil's cataract; (9) Rain forest; (10) Palm grove; (11) Baobab tree, 69 feet in circumference.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

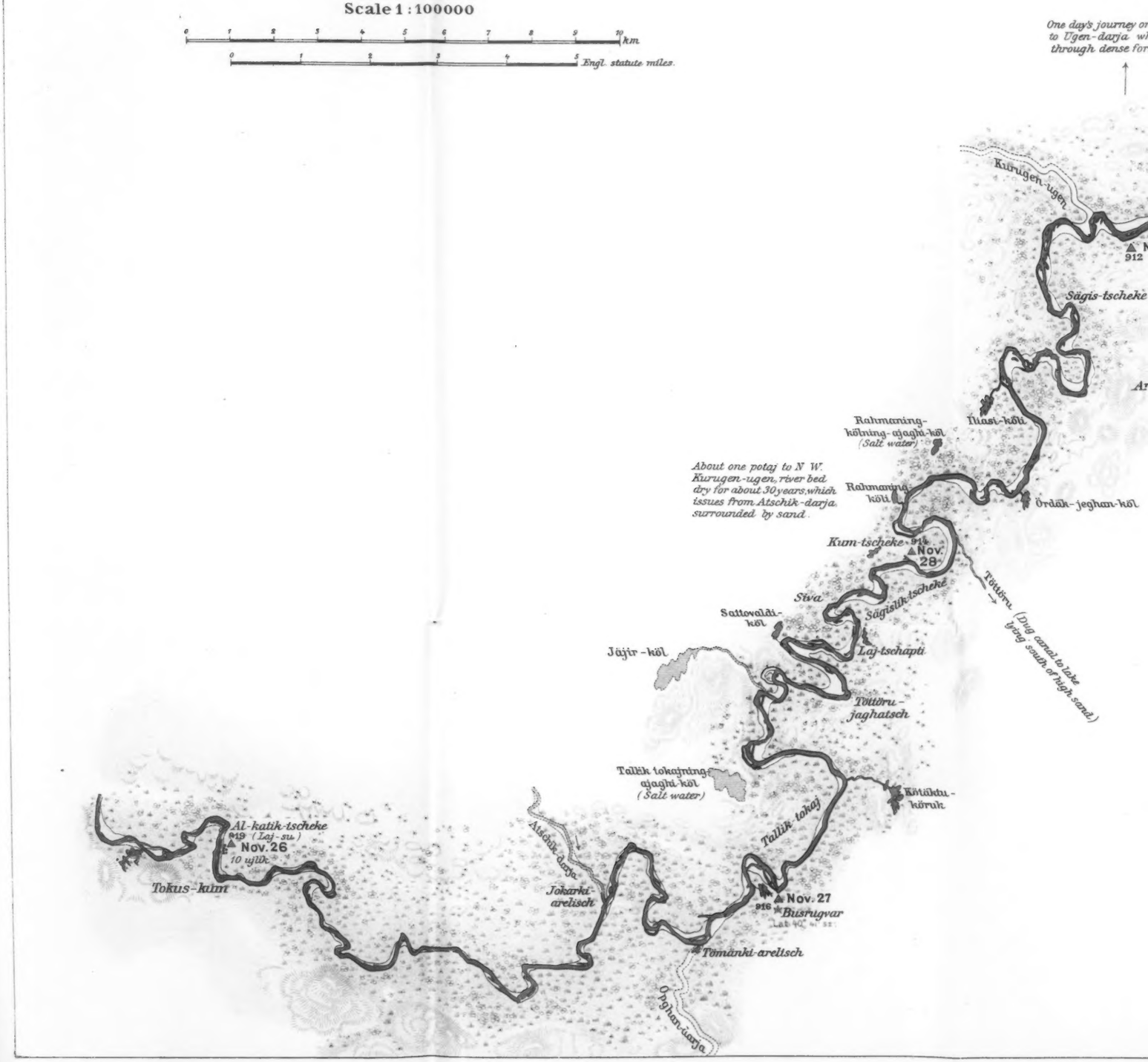
From LAJLIK to JANGI-KÖL

Nov. 26 – Dec. 2

Scale 1 : 100000

0 1 2 3 4 5 6 7 8 9 10 km

0 1 2 3 4 5 Engl. statute miles.

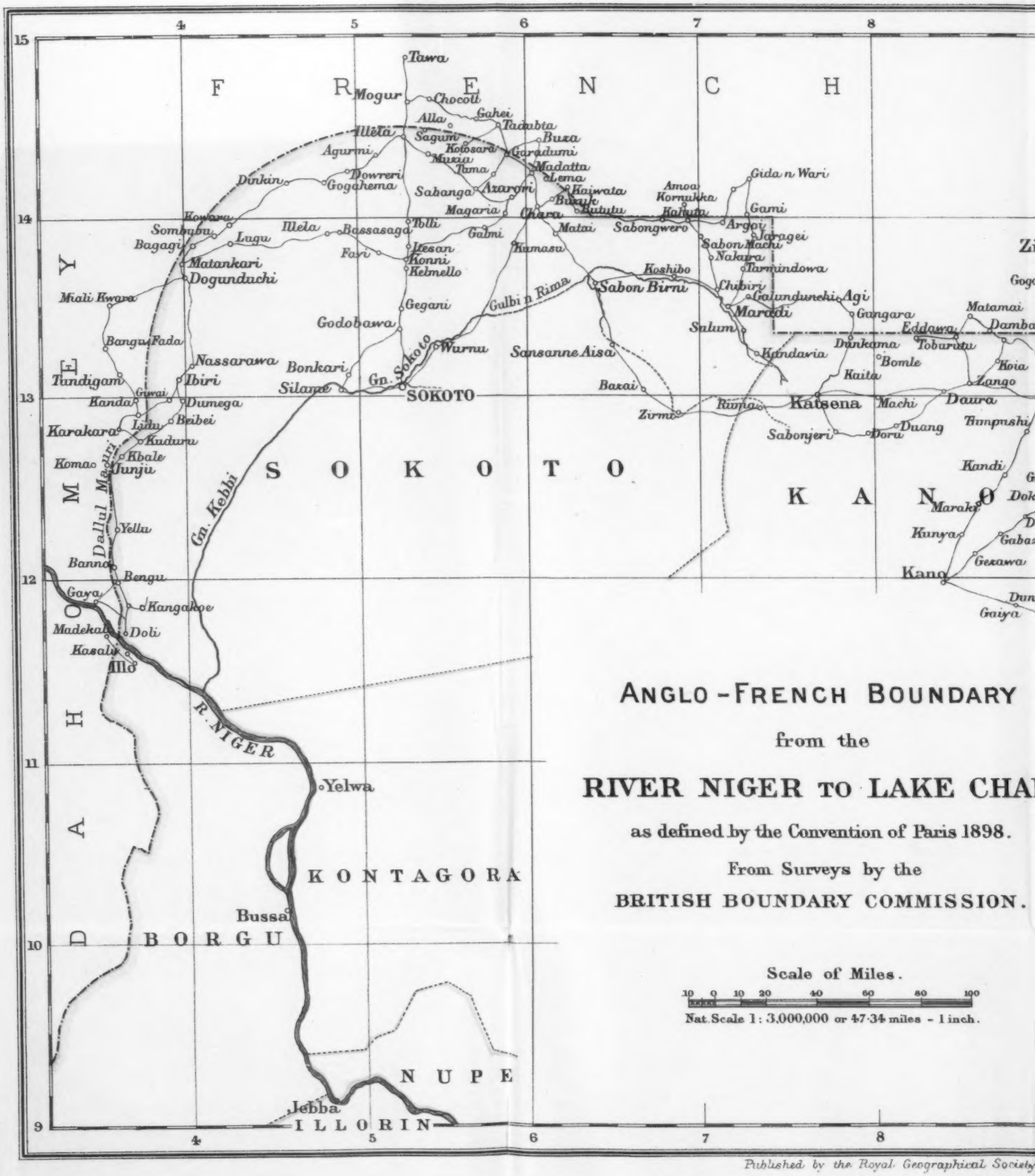


Constr. and drawn by H. Byström

Published by the Royal Geogr

Geographical Society

Generalstabens Litografiska Anstalt, Stockholm.



ANGLO-FRENCH BOUNDARY

from the

RIVER NIGER TO LAKE CHA

as defined by the Convention of Paris 1898.

From Surveys by the

BRITISH BOUNDARY COMMISSION.

Scale of Miles.

10 0 10 20 40 60 80 100

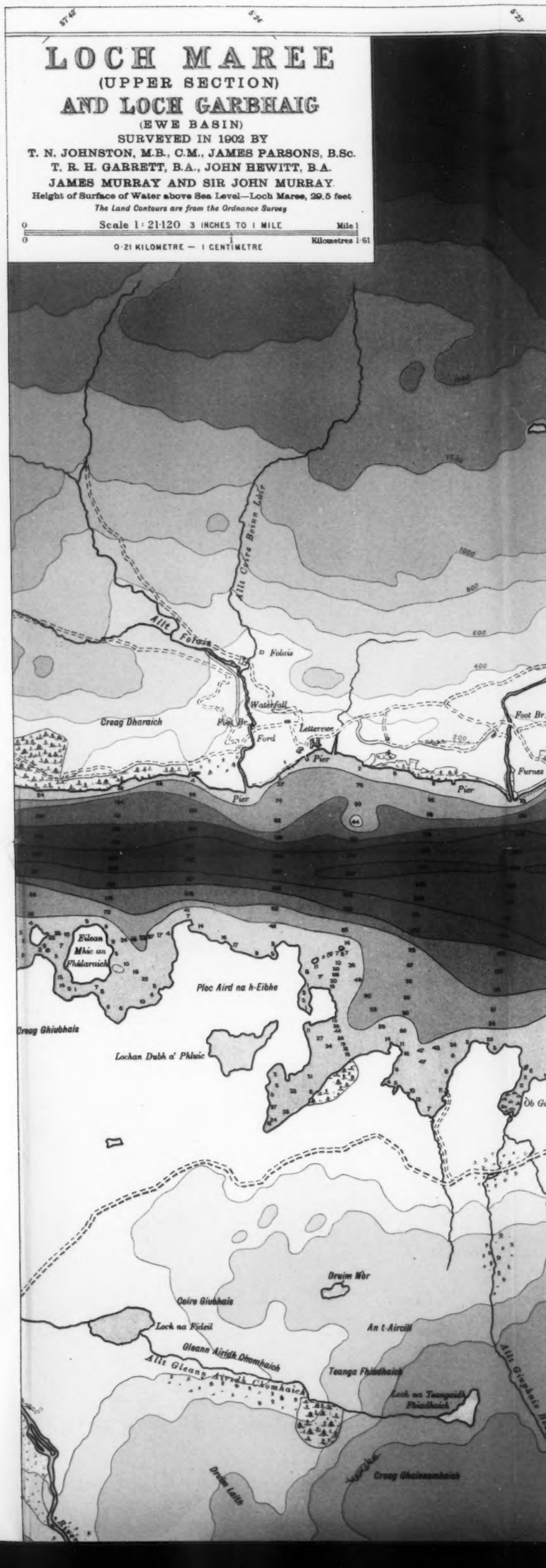
Nat. Scale 1: 3,000,000 or 47·34 miles = 1 inch.

Published by the Royal Geographical Society

RIVER NIGER TO LAKE CHAD.

BRITISH BOUNDARY COMMISSION.

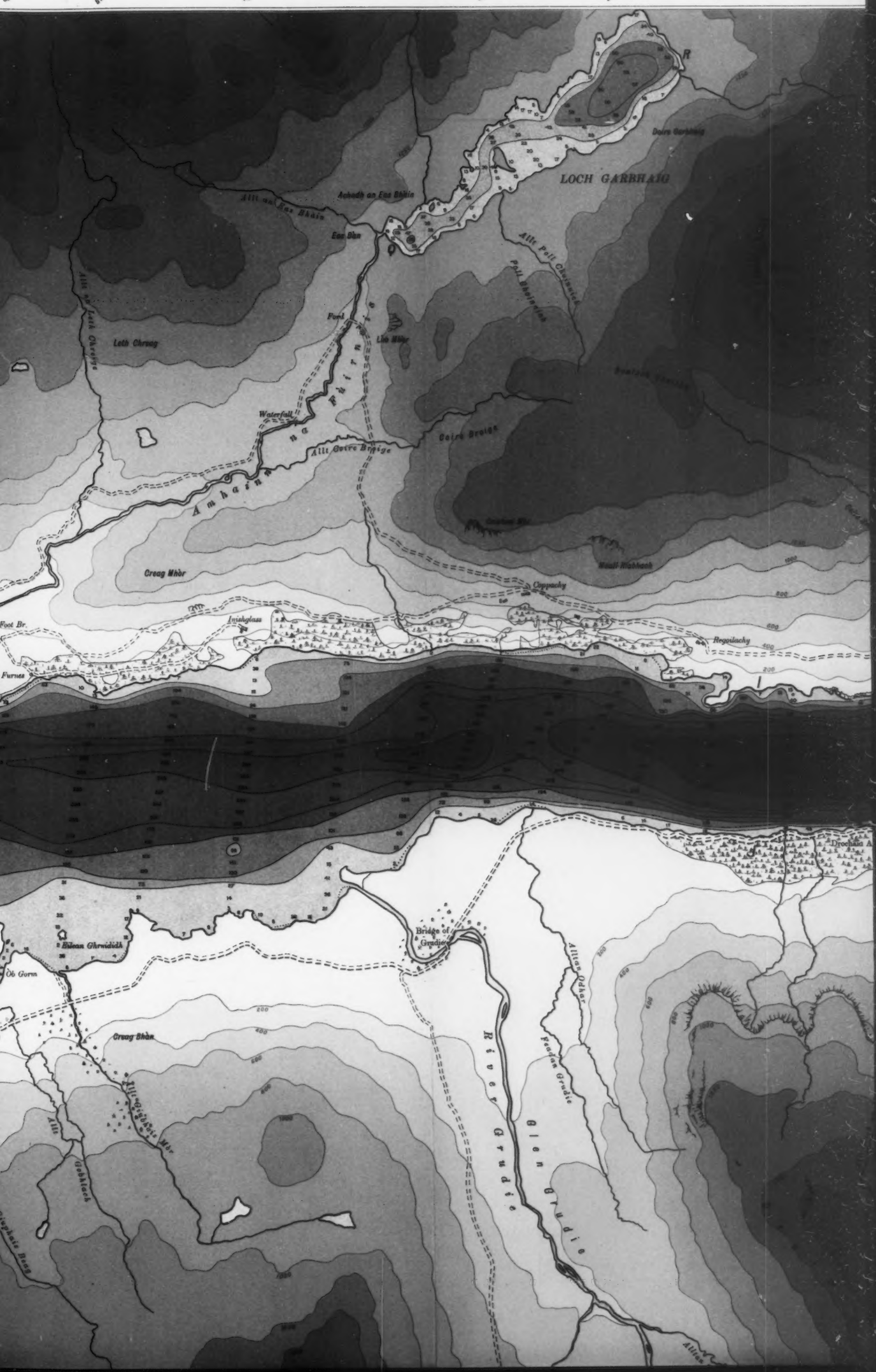
PLATE I


LOCH MAREE
(UPPER SECTION)
AND LOCH GARBHAIG
(EWE BASIN)
SURVEYED IN 1902 BY
T. N. JOHNSTON, M.B., C.M., JAMES PARSONS, B.Sc.
T. R. H. GARRETT, B.A., JOHN HEWITT, B.A.
JAMES MURRAY AND SIR JOHN MURRAY.
Height of Surface of Water above Sea Level—Loch Maree, 29.5 feet
The Land Contours are from the Ordnance Survey
Scale 1 : 21120 3 INCHES TO 1 MILE
Mile 1
0·21 KILOMETRE — 1 CENTIMETRE
Kilometres 1·61
57° 45'
5'24
5'23
Allt Coire Basan Lairig
Allt Folais
Folais
Waterfall
Creag Dharaich
Ford
Letterewe
Pier
Foot Br.
Furnes
Eilean Mhic an Fhilaraich
Ploc Aird na h-Eibhe
Creag Ghiubhais
Lochan Dubh a' Phluic
Druim Mor
Coire Giubhais
Loch na Fideil
An t-Aircill
Gleann Airidh Chombaich
Allt Gleann Airidh Chombaich
Teanga Fhiadhaich
Loch na Teanguidh Fhiadhaich
Creag Ghaineamhaich
Druim Leith

Bathymetrical Survey of the Fresh-water L

UNDER THE DIRECTION OF

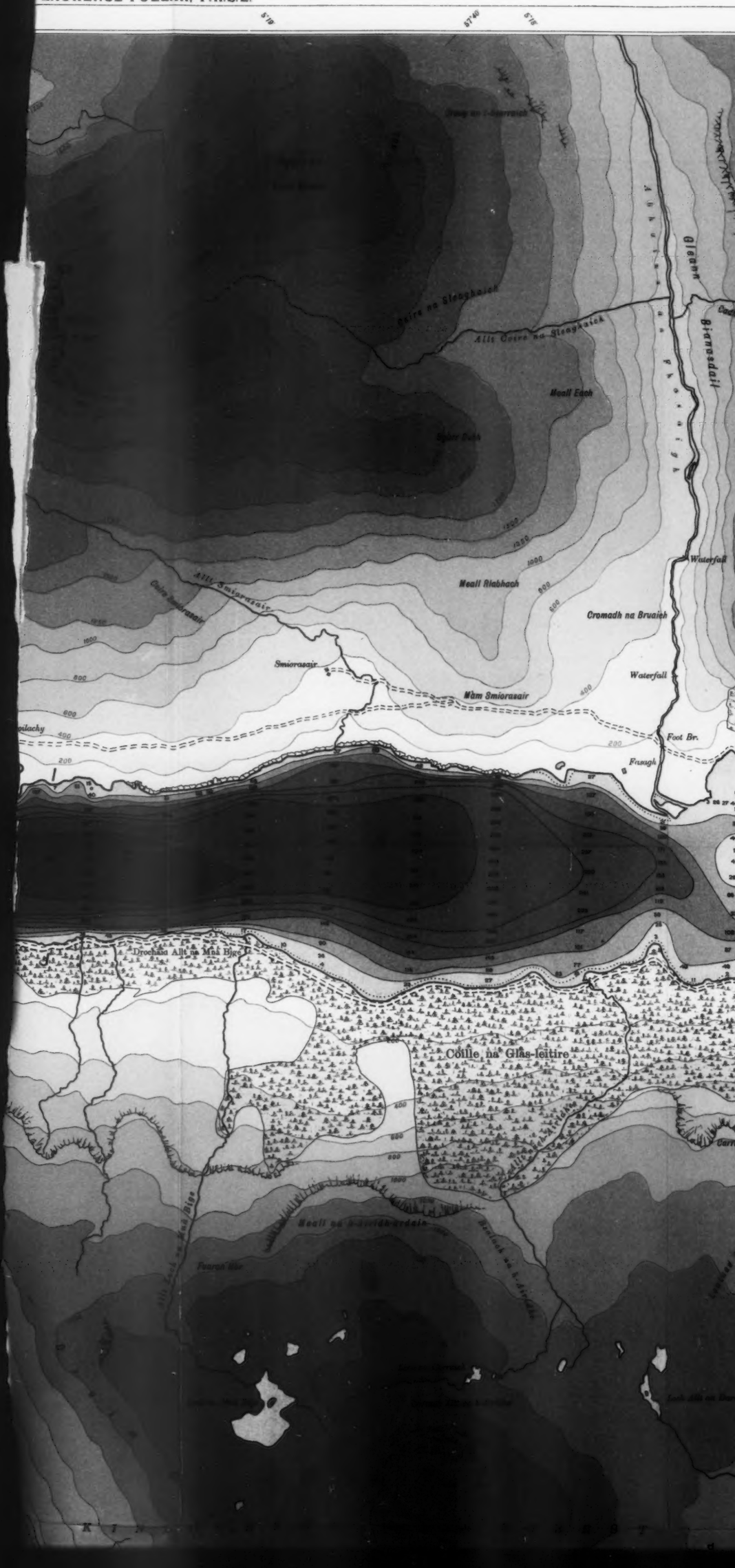
SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULL

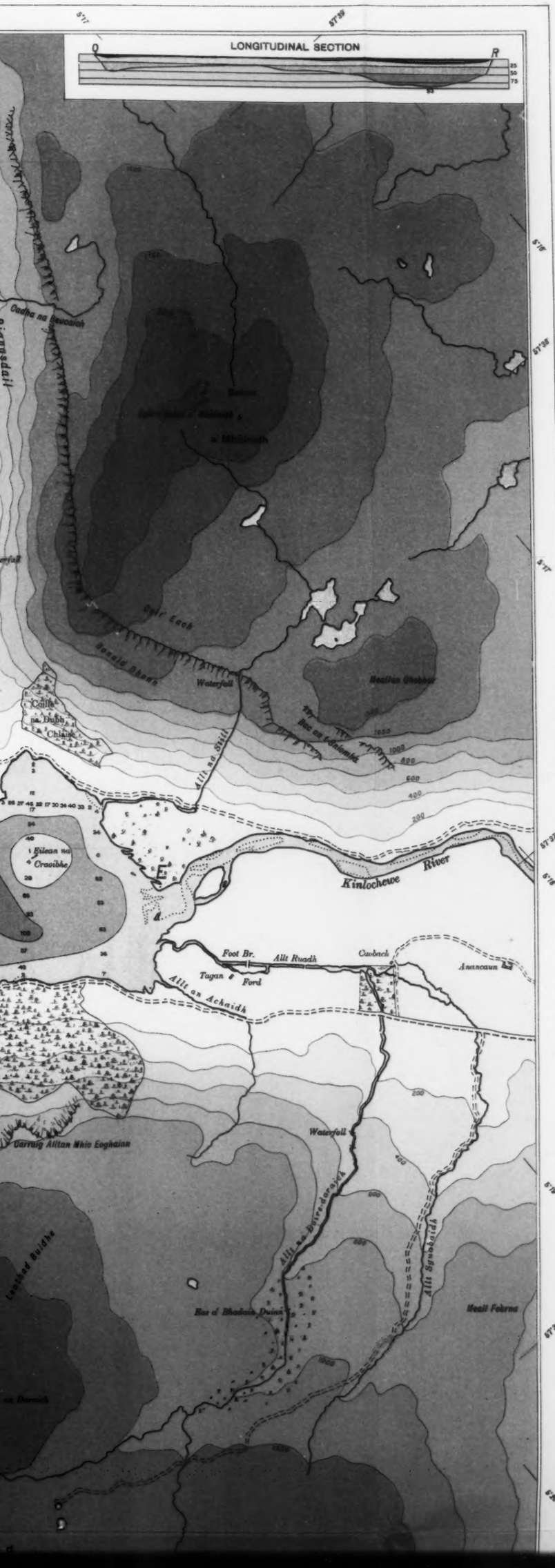


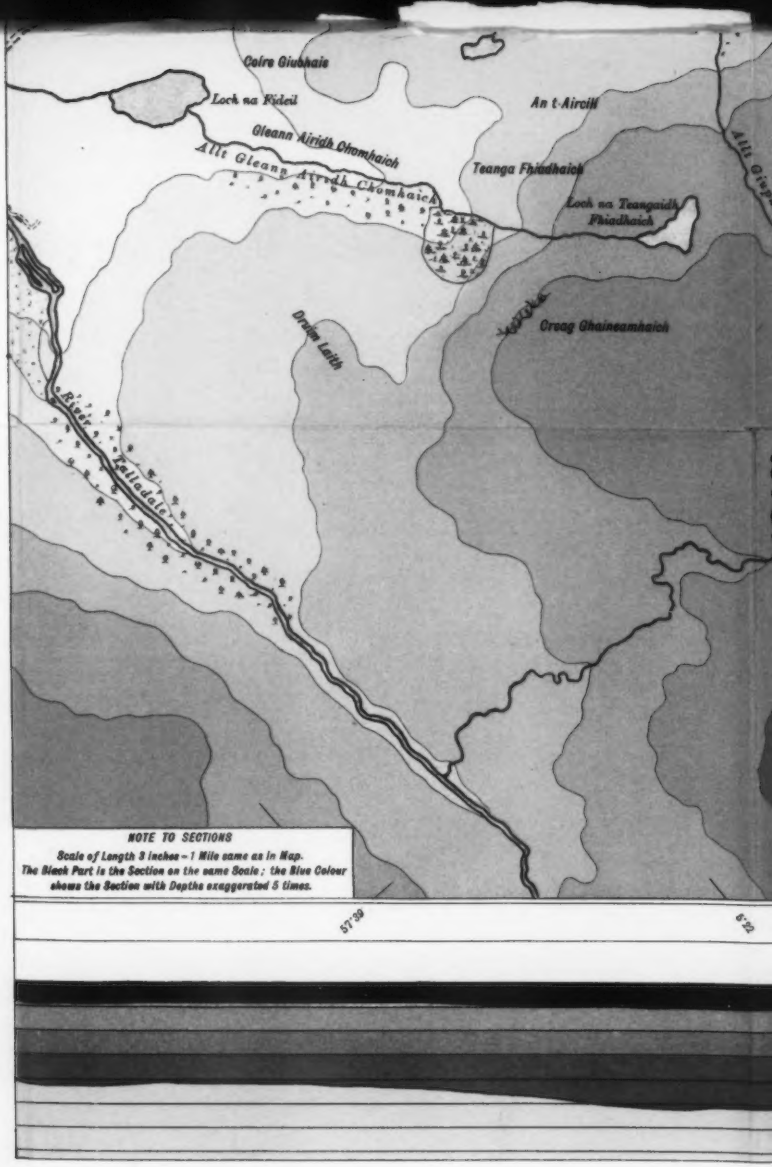
SH-WATER LOCHS OF SCOTLAND

N OF

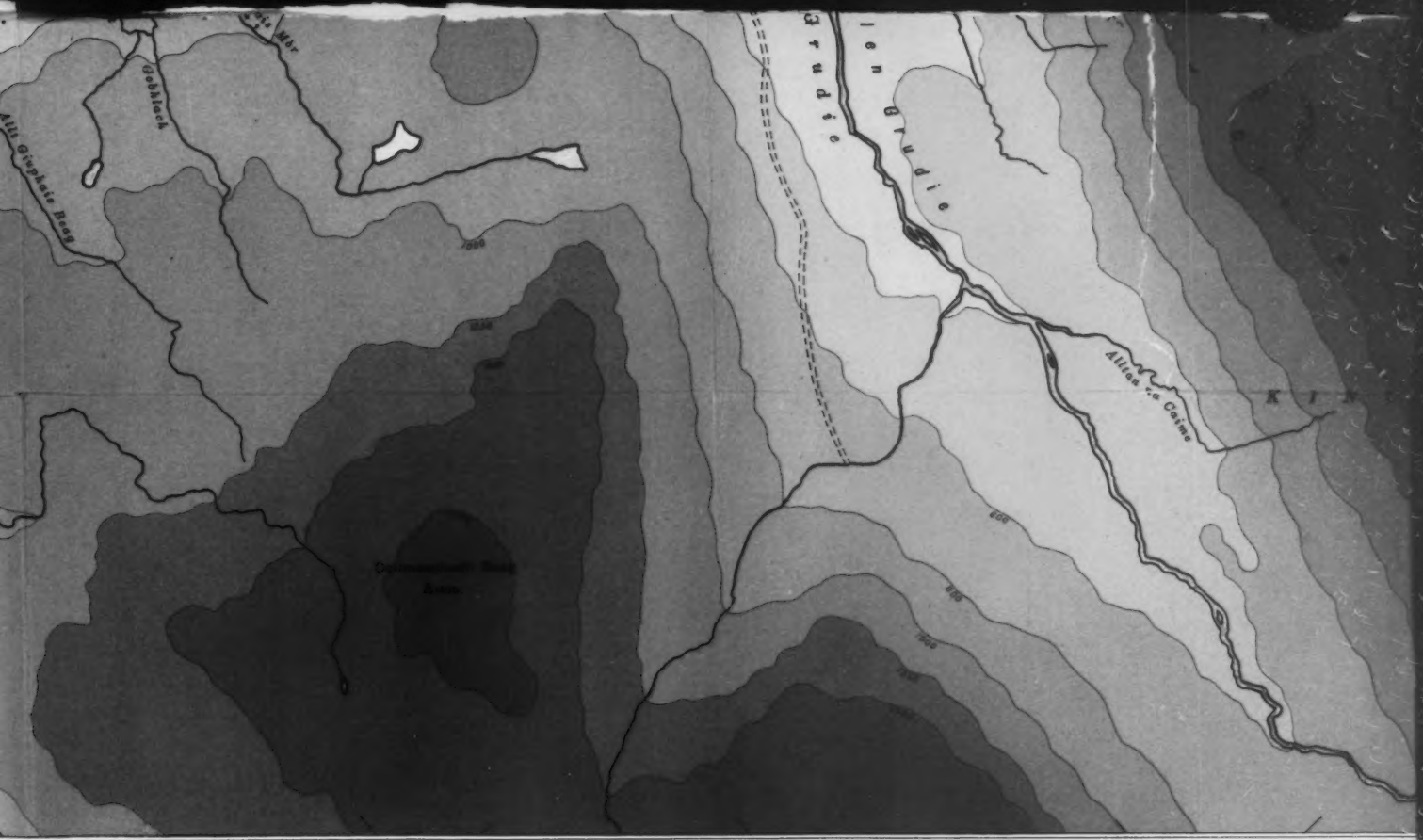
LAURENCE PULLAR, F.R.S.E.




LONGITUDINAL SECTION
O
R
25
50
75
Cadha na Beucaich
Sgor Each
Beinn Dhubh
Waterfall
Coire na Dubh Chlaise
Allt na Stiall
Eilean Mor
Craoibhe
Kinlochewe River
Foot Br.
Allt Ruadh
Cuibach
Tagan & Ford
Allt an Achaidh
Waterfall
Carraig Ailtan Mhic Eoghainn
Allt na Doire-darach
Allt Sgoadaidh
Beall Feirna
HEIGHTS IN FEET
FEET
METRES
3000 914·4
2750 838·2
2500 762
2250 685·8
2000 609·6
1750 533·4
1500 457·2
1250 381·1
1000 304·8
800 243·8
600 182·9
400 121·9
200 61
DEPTHS IN FEET
FEET
METRES
25 7·6
50 15·2
75 22·9
100 30·5
150 45·7
200 61
250 76·2
300 91·4
350 106·7

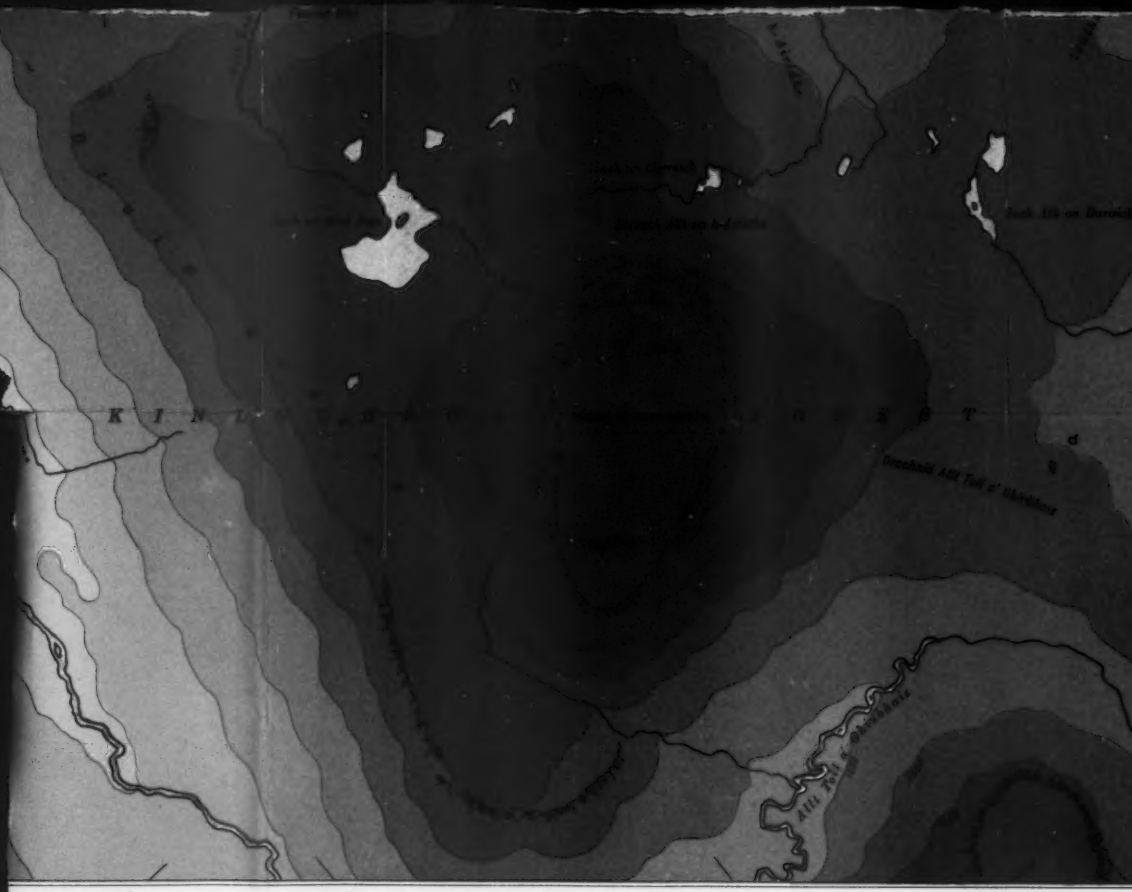

Coire Giubhais
Loch na Fideil
An t-Aircill
Gleann Airidh Chomhaich
Allt Gleann Airidh Chomhaich
Teanga Fhiadhaich
Loch na Teangaidh Fhiadhaich
Creag Ghaineamhaich
Druim Leith
River Talladale
NOTE TO SECTIONS
Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part is the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.
57·39
6·52

The Edinburgh Geographical Institute



LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

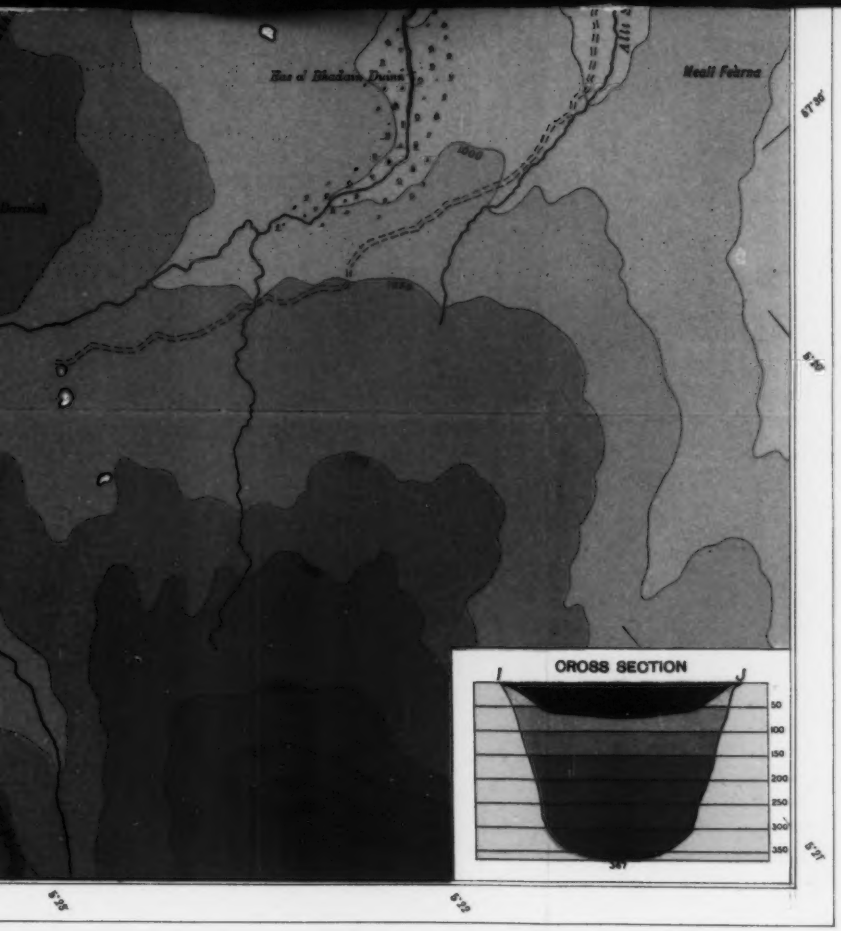
Published by the Royal Geographical Society.



57°37' 6°25' 6°24 57°36'

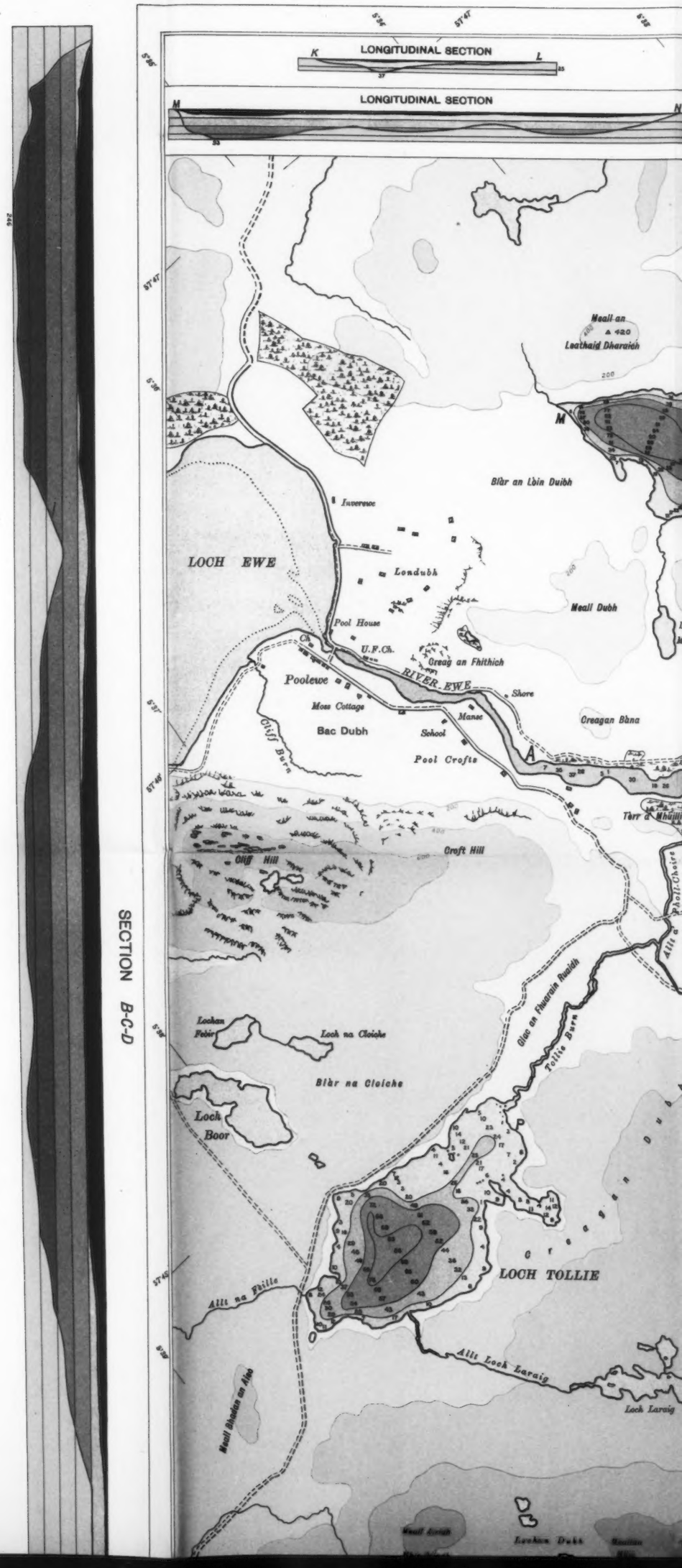
AXIMUM DEPTH

Geographical Society.



J. G. Bartholomew

PLATE II

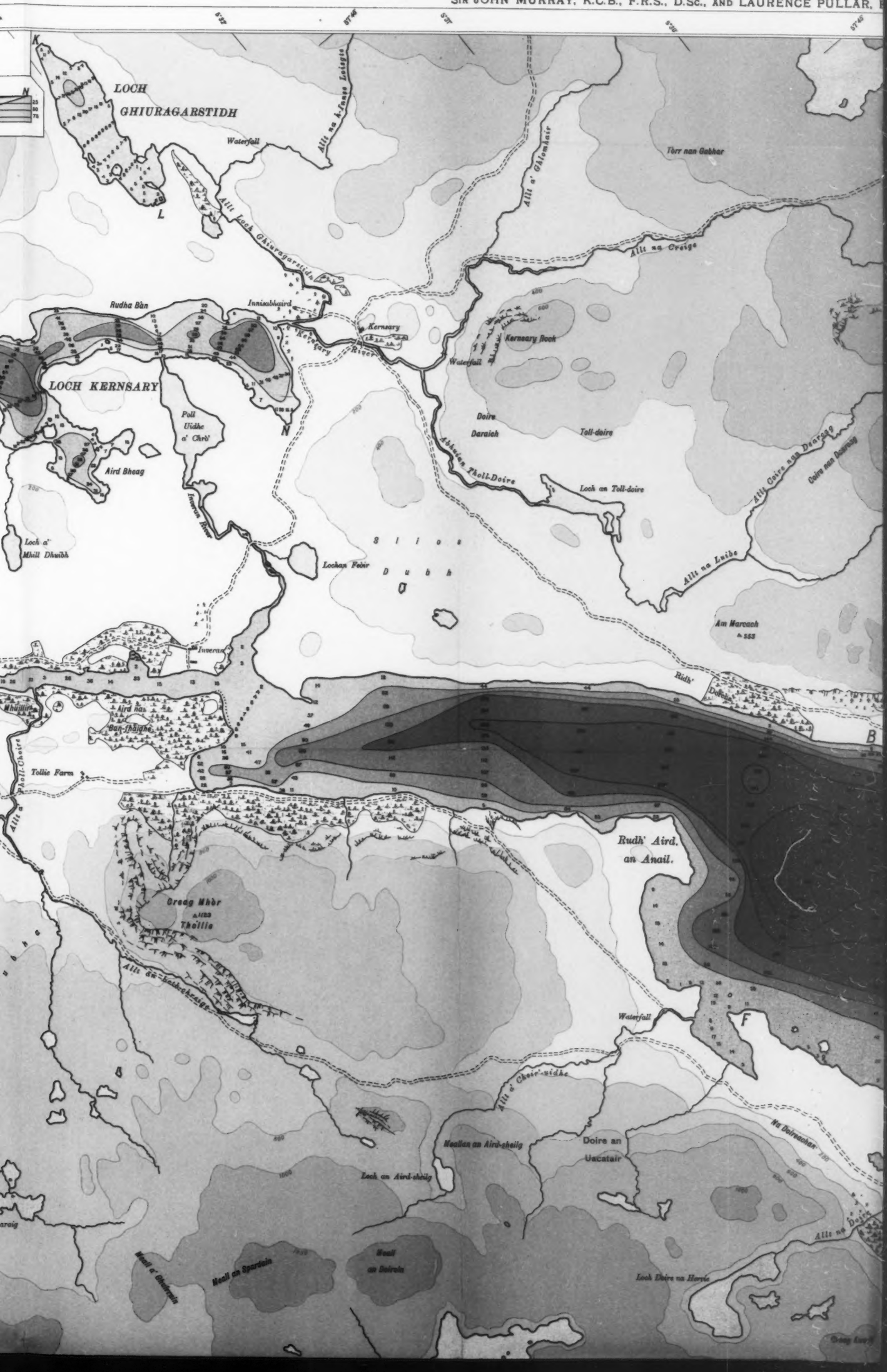


SECTION B-C-D

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOC

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR,



FRESH-WATER LOCHS OF SCOTLAND

DIRECTION OF

SC., AND LAURENCE PULLAR, F.R.S.E.

LOCH MAREE
(LOWER SECTION)
LOCH KERNSARY, LOCH TOLLIE, AND LOCH GHIURAGARSTIDH
(EWE BASIN)

SURVEYED IN 1902 BY
T. N. JOHNSTON, M.B., C.M., JAMES PARSONS, B.Sc.
T. R. H. GARRETT, B.A., JOHN HEWITT, B.A.
JAMES MURRAY AND SIR JOHN MURRAY.

Height of Surface of Water above Sea Level—Loch Maree, 29.5 feet
Loch Kernsary, 68.0 feet, Loch Ghiuragarstidh, 116.7 feet

The Land Contours are from the Ordnance Survey

Scale 1 : 21120 3 INCHES TO 1 MILE
0 Mile 1
0 1 Kilometres 1·61
0·21 KILOMETRE — 1 CENTIMETRE

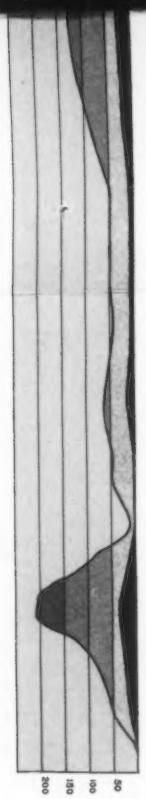
HEIGHTS IN FEET

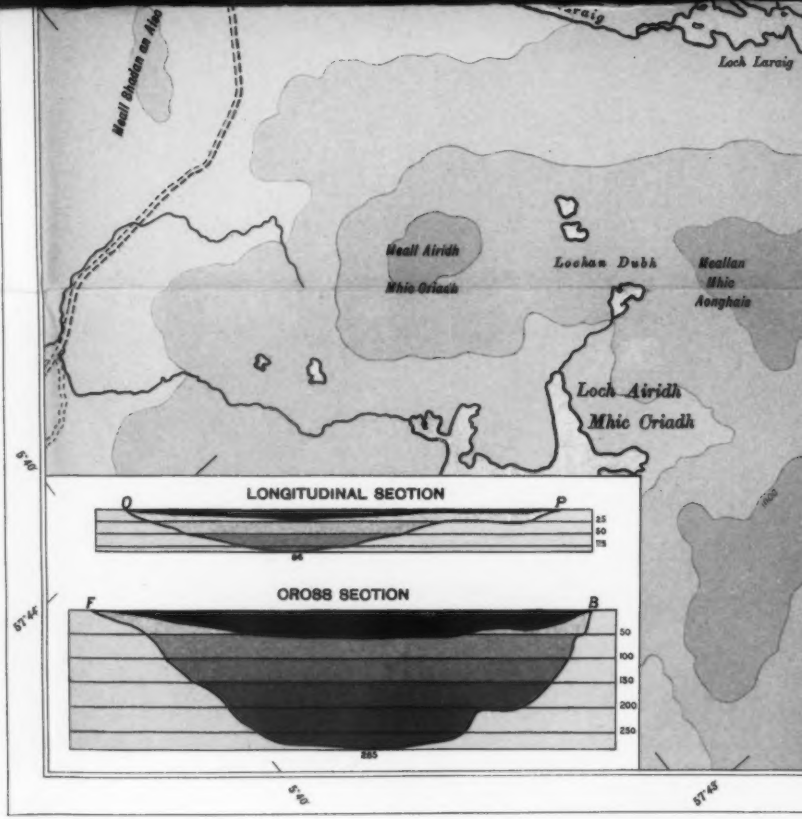
FEET	METRES
2500	762
2250	685·8
2000	609·6
1750	533·4
1500	457·2
1250	381·1
1000	304·8
800	243·8
600	182·9
400	121·9
200	61

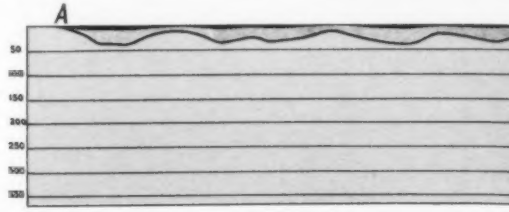
DEPTHS IN FEET

FEET	METRES
25	7·6
50	15·2
75	22·9
100	30·5
150	45·7
200	61
250	76·2

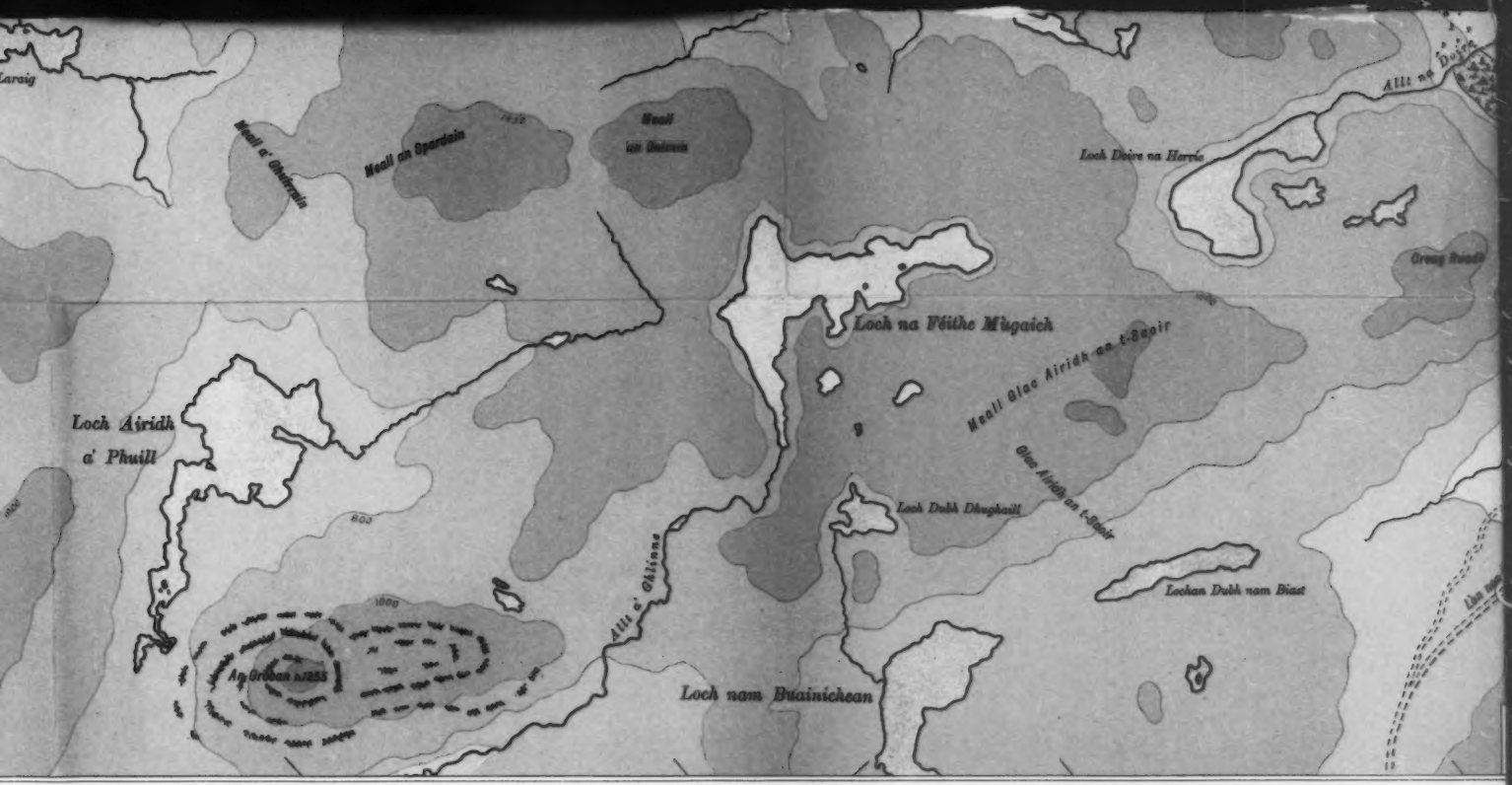
Ferd
Strathasmore
Caire Reidh
Chirnan Maire
Chirn Mhic Lebid
Allt Glac Iain Dyilb
Caire Glas
Allt Ruiha Chailltaich
Allt Airidh an Eilein
Airidh an Eilein
Creag Tharbh
Eilean Eachaidh
Eilean Subhainn
Eilean Loisgte
Camas a Chonnaidh
Garbh Eilean
Eilean Dubh Beag
Pier
Talladale
Talladale Hotel
Ice Slaughach
Bein d' Choit
970





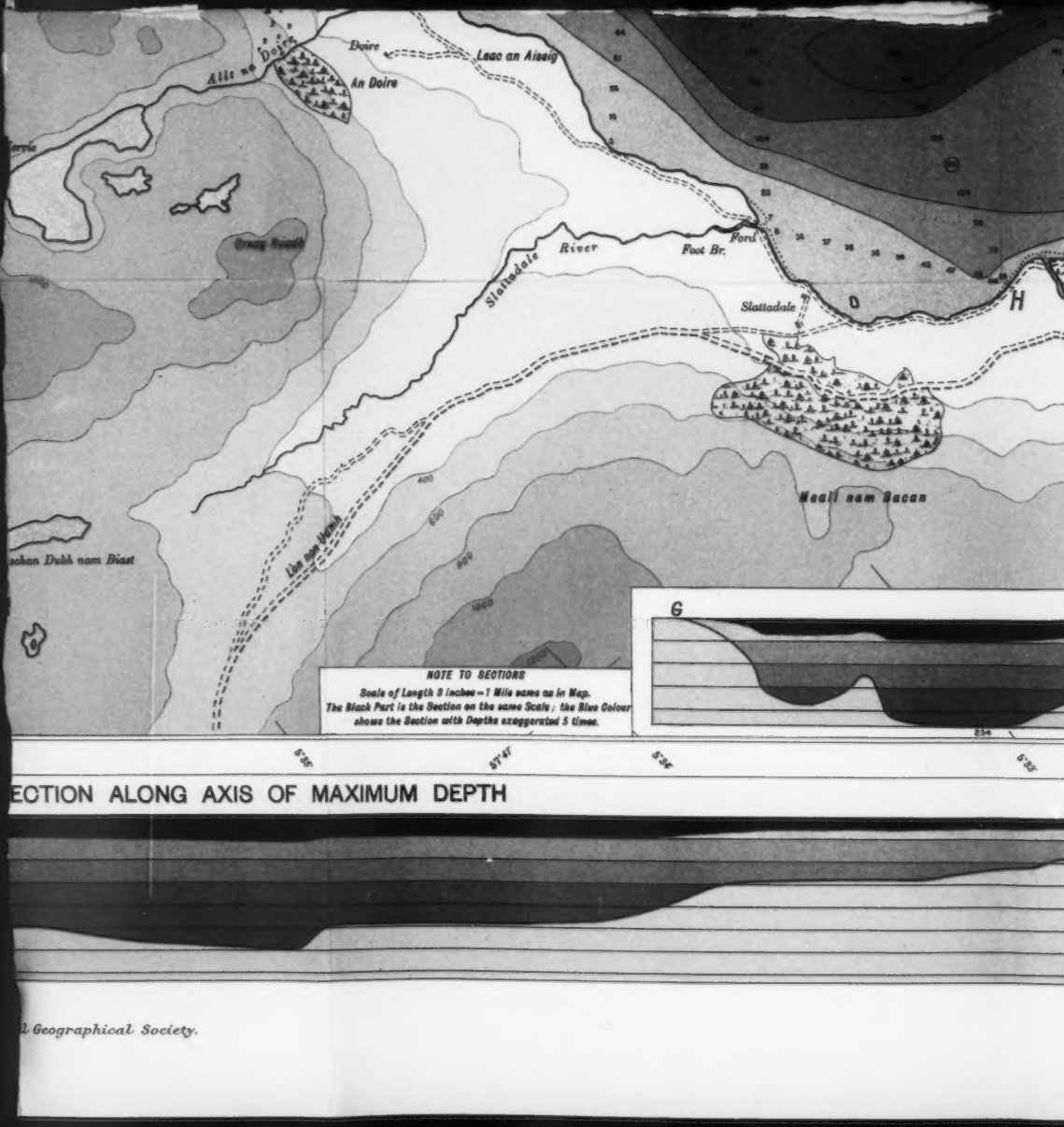


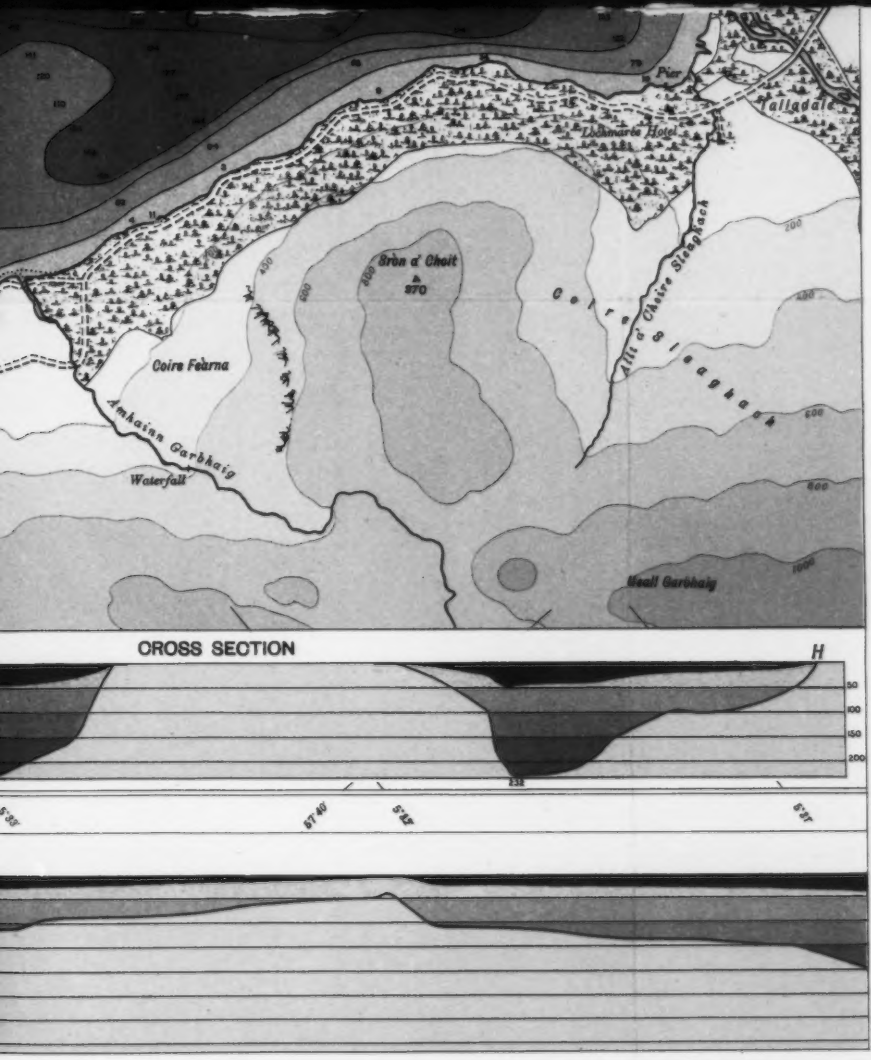
The Edinburgh Geographical Institute



LONGITUDINAL SECTION ALONG AXIS OF M

Published by the Royal Geographical Society.


Doire
Leac an Aisaig
An Doire
Ford
Foot Br.
River
Slattadale
D
H
Meall nam Bacan
NOTE TO SECTIONS
Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part is the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.
G
234
5'35
57'47
5'36
5'35
ECTION ALONG AXIS OF MAXIMUM DEPTH



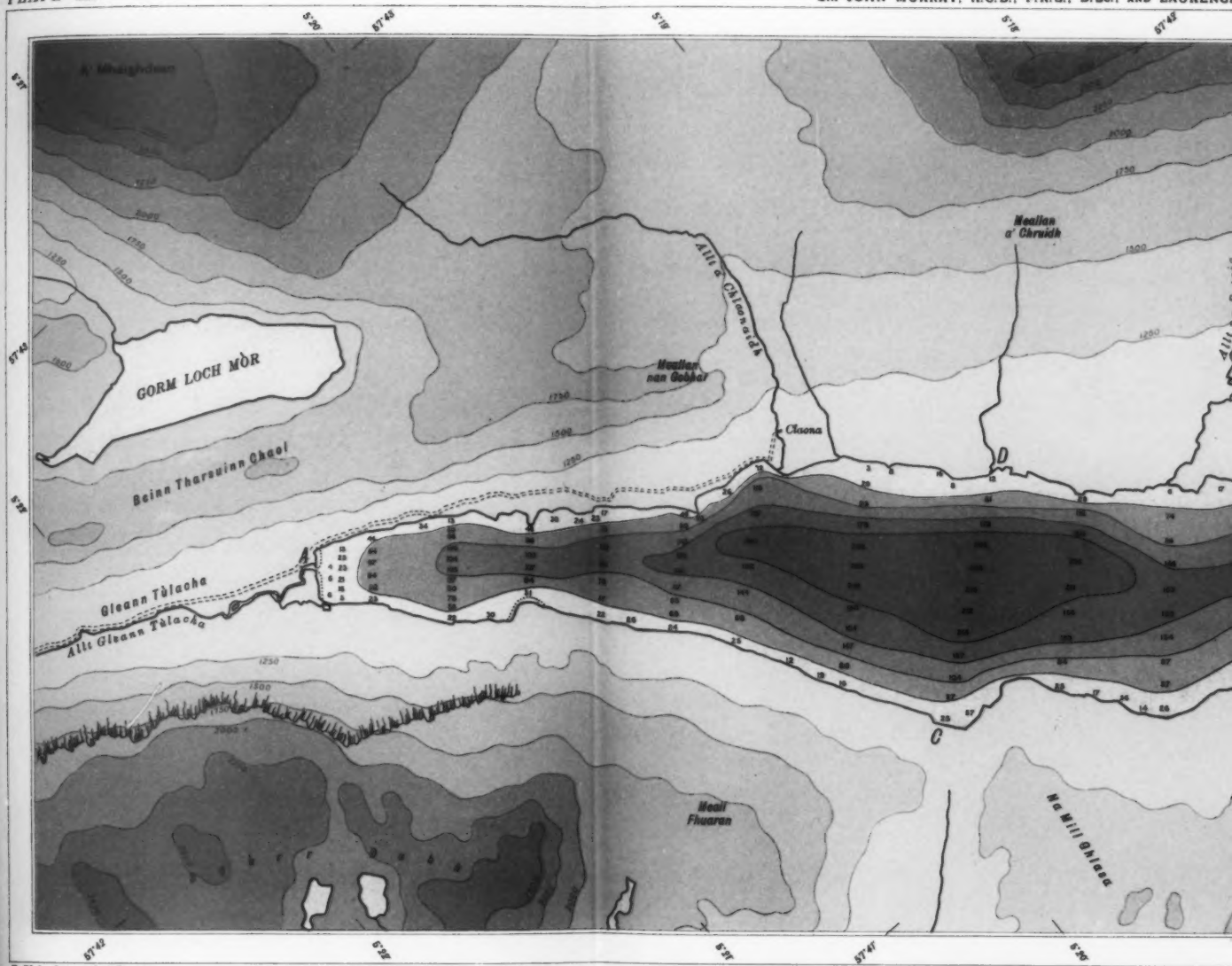
J. G. Bartholomew.

PLATE III

BATHYMETRICAL SURVEY OF THE FRESH-WATER

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE

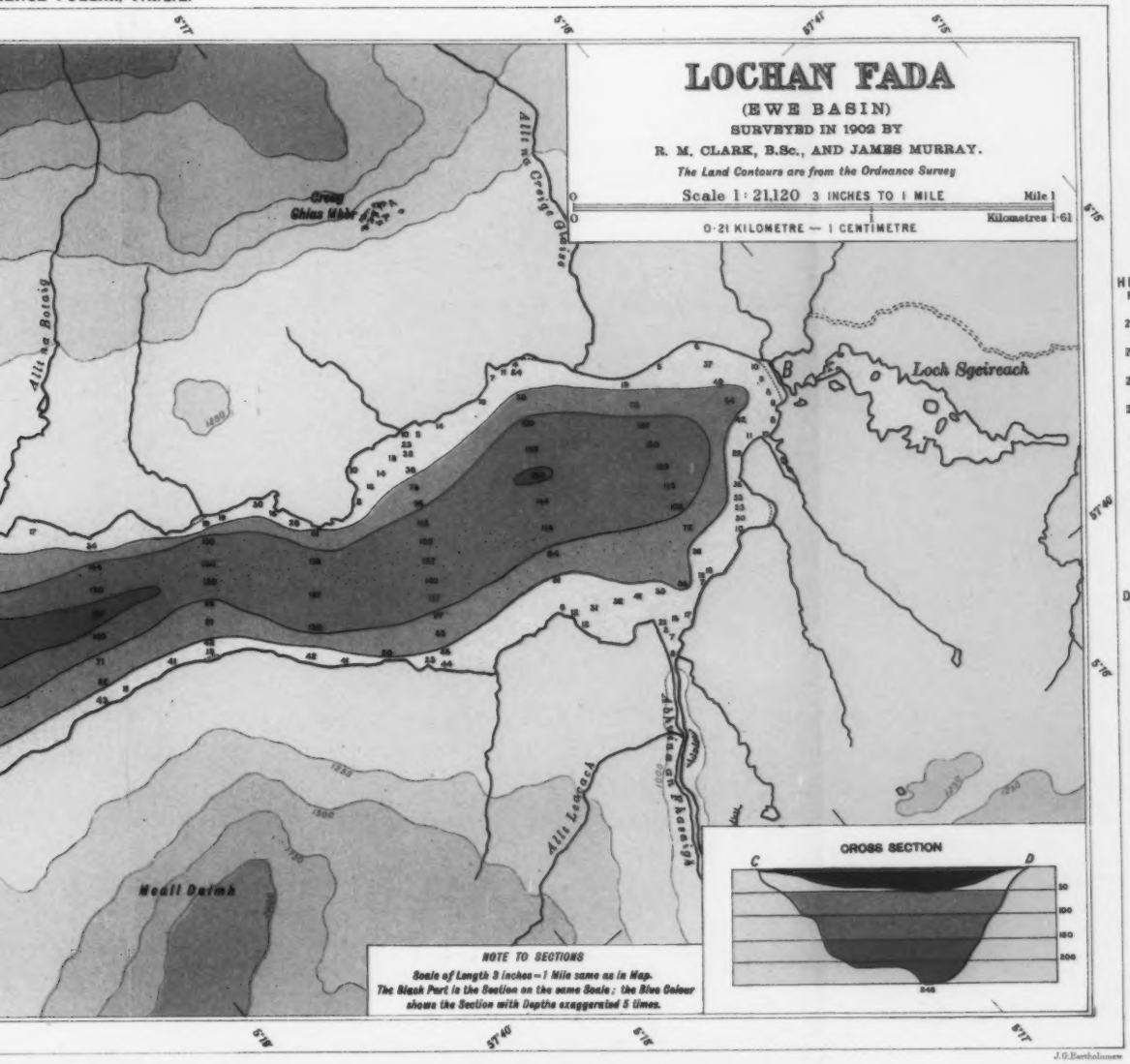


The Edinburgh Geographical Institute

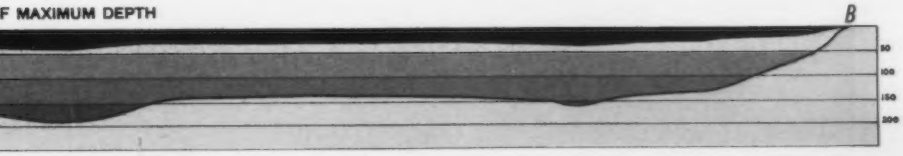
LONGITUDINAL SECTION ALONG AXIS OF MAX

Published by the Royal Geographical

HENCE PULLAR, F.R.S.E.



F MAXIMUM DEPTH

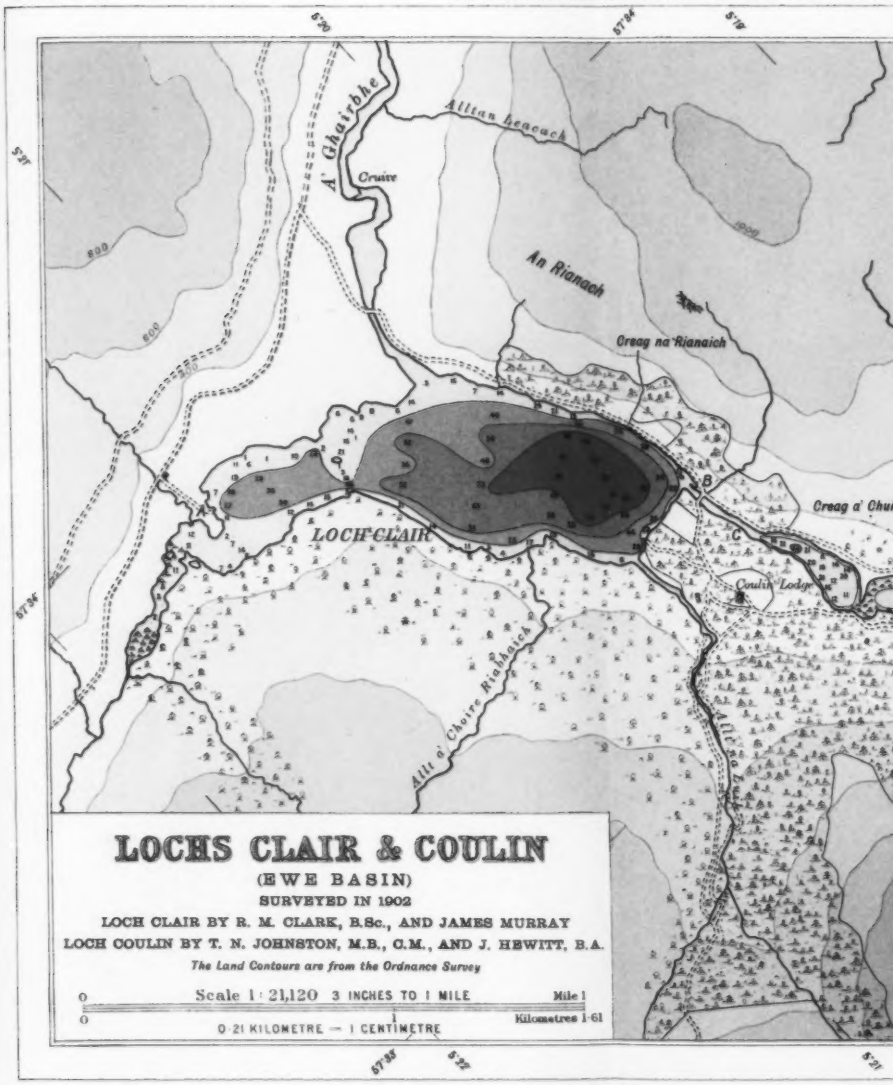


BATHYMETRICAL SURVEY OF THE FRESH-WAT

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURE

PLATE IV



LOCHS CLAIR & COULIN

(EWE BASIN)

SURVEYED IN 1902

LOCH CLAIR BY R. M. CLARK, B.Sc., AND JAMES MURRAY

LOCH COULIN BY T. N. JOHNSTON, M.B., C.M., AND J. HEWITT, B.A.

The Land Contours are from the Ordnance Survey

Scale 1 : 21,120 3 INCHES TO 1 MILE

Mile 1

Kilometres 1·61

0·21 KILOMETRE = 1 CENTIMETRE

LONGITUDINAL SECTIONS ALONG AXIS OF

The Edinburgh Geographical Institute

Published by the Royal Geographic

WATER LOCHS OF SCOTLAND

OF

AURENCE PULLAR, F.R.S.E.

THE GEOGRAPHICAL JOURNAL 1904

XIS OF MAXIMUM DEPTH

J.G.Bartholomew

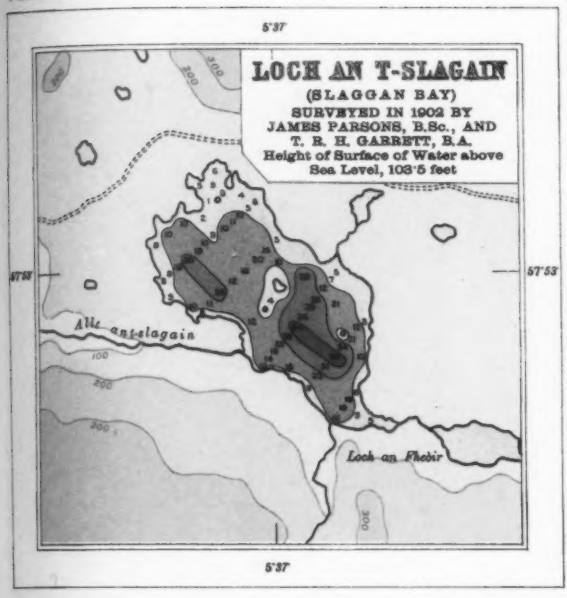
aphical Society.

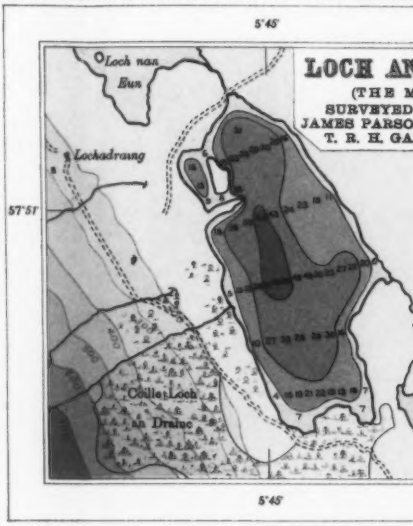
PLATE V

BATHYMETRICAL SURVEY OF THE FRESH-WAT

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAUREL

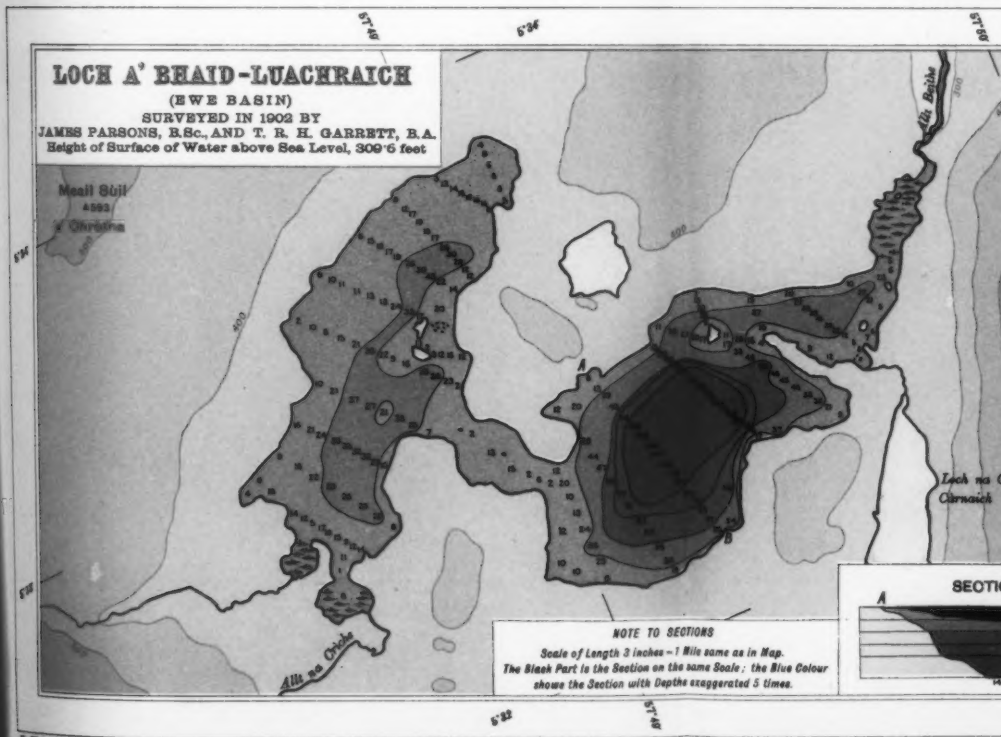




Scale 1 : 21120 3 INCHES TO 1 MIL

0·21 KILOMETRE — 1 CENTIMETRE

The Land Contours are from the Ordnance Surv


LOCH A' BHAID-LUACHRAICH
(EWE BASIN)
SURVEYED IN 1902 BY
JAMES PARSONS, B.Sc., AND T. R. H. GARRETT, B.A.
Height of Surface of Water above Sea Level, 309·6 feet
Meall Still
4593
Chràdha
Allt Baiba
Allt na Oiche
Loch na
Carnaich
NOTE TO SECTIONS
Scale of Length 2 inches = 1 Mile same as in Map.
The Black Part in the Section on the same Scale; the Blue Colour
shows the Section with Depths exaggerated 5 times.
SECTI
A

The Edinburgh Geographical Institute

Published by the Royal Geographical

WATER LOCHS OF SCOTLAND

AURENCE PULLAR, F.R.S.E.

I AN DRAING
HE MINCH)
EYED IN 1902 BY
ARSONS, B.Sc., AND
H. GARRETT, B.A.

57°51'

Loch an Leoigh

1 MILE Mile 1

Kilometres 1·61

TRE

nce Survey

5'47'

Blàr a' Chinn Ghaineamhaich

Uisidh Chrò

100

57°49'

200

Abhainn Ur

LOCH SGUOD
(EWE BASIN)
SURVEYED IN 1902 BY
JAMES PARSONS, B.Sc., AND
T. R. H. GARRETT, B.A.

57°49'

5'47'

HEIGHTS IN FEET

FEET	METRES
700	213·4
600	182·9
500	152·4
400	121·9
300	91·4
200	61
100	30·5

5'33'

57°48'

ch na Claise
rnaich

SECTION

B

75
50
75
100

143

5'32'

5'31'

Carn Bàn na h-Achlaise

LOCH MHIC 'ILLE RIABHAICH
(EWE BASIN)
SURVEYED IN 1902 BY
JAMES PARSONS, B.Sc.

Allt na Criche

57°48'

Loch an Eilein

5'32'

5'31'

J.G.Bartholomew.

DEPTHS IN FEET

FEET	METRES
10	3·05
25	7·6
50	15·2
75	22·9
100	30·5

ohical Society.

BATHYMETRICAL SURVEY OF THE FRESH

UNDER THE DIRECTION

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND L

LEWE
LOCH
Isle of Ewe
Loch Fada
Loch Thurnaig
Aird Dhubh
Beag
Beinn a' Chaisgein Mor
Dubh Loch
Sgurr Ban
Sgurr Dubh
Coulin Forest
Kinlochewe Forest
Torridon Forest
Flowerdale Forest
Shieldaig Forest
Ben Damph Forest
Beinn Dearg
BEINN ALLIGIN
Beinn an Eoin
Beinn Damh
UPPER LOCH TORRIDON
LOCH SHIELDAIG
Glenshieldaig Forest
Glen Grudie
River Grudie
Strath Lungard
Strath Suardalan
Strath a' Chonais
Allt a' Chonais
Allt na Laoidh
Allt Coire Mhic Nobuil
Allt Coire Mhic Fhearchair
Allt Toll a' Mhadaidh
Allt Fionn Loch
Allt Gleann Dubh
Allt Mhic Nobuil
Allt Coire Beinne Leithe
Allt Coire Dubh Mor

ESH-WATER LOCHS OF SCOTLAND

CTION OF

AND LAURENCE PULLAR, F.R.S.E.

LOCH MAREE DISTRICT

SURFACE GEOLOGY

GENERALISED FROM THE MAPS OF H.M. GEOLOGICAL SURVEY

Scale 2 Miles to an Inch

0 1 2 3 Miles

J. G. Bartholomew

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DECEMBER, 1904. VOL. XXIV. No. 6.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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For Notices as to the Society's Meetings and other important matters, see p. iv.

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